VARIATIONS IN COSTS OF PRODUCING CORN, WHEAT, AND OTHER CROPS IN GREENE COUNTY, OHIO

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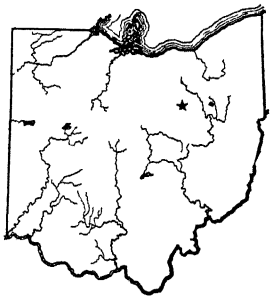

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VARIATIONS IN COSTS OF PRODUCING CORN, WHEAT, AND OTHER CROPS IN GREENE COUNTY, OHIO

J. I. FALCONER AND J. F. DOWLER

The records from which these data were taken were collected from 25 different farms in the vicinity of Cedarville and Jamestown in Greene County, Ohio, during the five years from 1920 to 1924.* The farms fairly represent the present general plan of farm organization and operation in effect in the west-central section of the State. Their present practices reflect their past experience and their theory of production economics, as far as circumstances have enabled them to put these into effect.

The absolute cost of producing any particular crop at any stated time is quite elusive and uncertain. The cost will vary on the same farm the same year and on each of all other farms at different times. The value of cost-of-production records does not lie in arriving at a single figure which might be spoken of as the cost of producing a bushel of grain or a unit of any commodity, but rather in recording the various factors that go to make up the costs and their variations on different farms. It is these factors that tell the story of efficiency or inefficiency in the organization of the farm and in the management of the various operations.

It is the aim of this bulletin to set forth the comparative costs of production on the various farms and on the various enterprises on these farms as a means of studying the weaknesses and strong

*The authors wish to acknowledge the valuable assistance of Mr. J. B. Hutson, of the Bureau of Agricultural Economics, who was in constant touch with the work during the collecting and compiling of the data; also to the following farmers, in the vicinity of Jamestown and Cedarville, who cooperated in furnishing the data from which the bulletin was prepared:

Anderson, William
Bailey, H. S.
Cherry, William J.
Clemans, Fred
Dobbins, Fred
Ewbank, N. P.
Finney, E. E.
Franklin, Clarence B.
Franklin, J. C.
Geary, A. F.
Johnson, Frank
Jones, H. N.
Kyle, D. M.
Lackey, Frank
McCampbell, J. A.
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Mott, C. W.
Murphy, C. W.
Paullin, D. E.
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Smith, Floyd
Stormont, Meryl
Turnbull, Hugh
Williamson, Collins
Williamson, Fred

points of such practices as are being used in crop production today; at the same time to give a good idea of the relative magnitude of the different factors which enter into the cost of production of farm crops; and to suggest methods to increase or decrease the volume of such factors for a more efficient production.

Fig. 1.—This study was carried on in Greene County in the vicinity of Cedarville and Jamestown. Conditions in this section are typical of the west-central section of the state

The route method was used in collecting the data, each farm being visited at least once a week, thereby securing complete records and the opportunity to check them. In all 25 farms were included in the study—11 for the entire five-year period from 1920 to 1924, 6 for four years, 2 for three years, 2 for two years, and 4 for one year.

PRESENT TYPE OF FARMING

Cropping practice.—The average area of the farms was 162 acres, of which 137 acres was in rotated crops and 10 acres in permanent pasture. The rotation most commonly followed is a three-year rotation of corn, wheat or oats, clover and timothy. Only a few farmers practiced a four-year rotation, which included two years of corn in succession. A very small portion of the grass was allowed to remain two years.

Corn was the main crop grown. In area it occupied 51 acres per farm, or 37 percent of the rotated crop area. Table 1 gives the acreages of the various crops on these farms in each of the five years of the study and also an average of all. Corn was used primarily for feeding purposes, with only a few farms making a business of selling it. A large proportion of the corn was marketed thru hogs, with a smaller percentage thru dairy products, sheep, and a few beef cattle. Of the corn 63 percent was planted after grass, 23 percent after corn, 7 percent after wheat, and 7 percent after oats. The average yield for the five years was 45 bushels.

Wheat ranked second in area among the crops grown. It was used almost entirely as a cash crop, only small amounts being fed to livestock. The major portion of the wheat followed corn. Only a very small acreage was sown on plowed land. Wheat fits into the rotation as a very desirable nurse crop for young clover and timothy. The average yield was 18.4 bushels.

TABLE 1.—Distribution of Crop Acreage and Total Acreage on Farms Studied

Item	Percent of rotated area	Average acres per farm					
		5-year average	1920	1921	1922	1923	1924
Corn	37	51	46	44	51	57	54
Wheat	20	27	25	24	25	30	32
Oats	9	13	15	14	13	10	17
Rye	1	1	1	2	2	1	1
Soybeans	1	2	0	0	0	1	8
Rotated pasture	18	24	26	22	20	26	27
Hay	12	17	16	18	23	14	12
Alfalfa	1	1	1	1	1	2	1
Miscellaneous	1	1	1	1	1	1	2
Rotated farm area		137	130	126	135	140	154
Permanent pasture		10	8	9	9	10	12
Farm area		162	154	150	160	167	180

Oats ranked below wheat in area. Some farms grew both of these small grains, while others grew only one of them. Like wheat, oats followed corn and also served as a nurse crop for grass. Usually the oats were sown on the corn ground from which the corn was husked off the stalk or hogged down. The oats were used ordinarily as a feed crop, but where they were the only small grain grown a portion was usually sold. The average yield of oats was 32.1 bushels.

TABLE 2.—Crop Yields: Average by Years and for the Five-year Period on All Farms, 1920-1924

Crop	Average yield per acre					
	1920	1921	1922	1923	1924	1920—24
Corn.....Bu..	49.2	51.0	54.6	39.9	34.4	45.0
Wheat.....Bu..	15.4	15.1	18.6	21.9	20.8	18.4
Oats.....Bu..	44.0	17.1	25.8	23.8	50.0	32.1
Hay.....Tons..	1 1	1.2	1.2	1.1	1.0	1.12

The area of clover and timothy grown for rotated pasture and hay was slightly more than the area of wheat and oats combined. On the average about 17 acres out of 41 acres in grass was made into hay, the remainder being pastured. Oftentimes considerable pasture was obtained from the meadow before it was cut for hay.

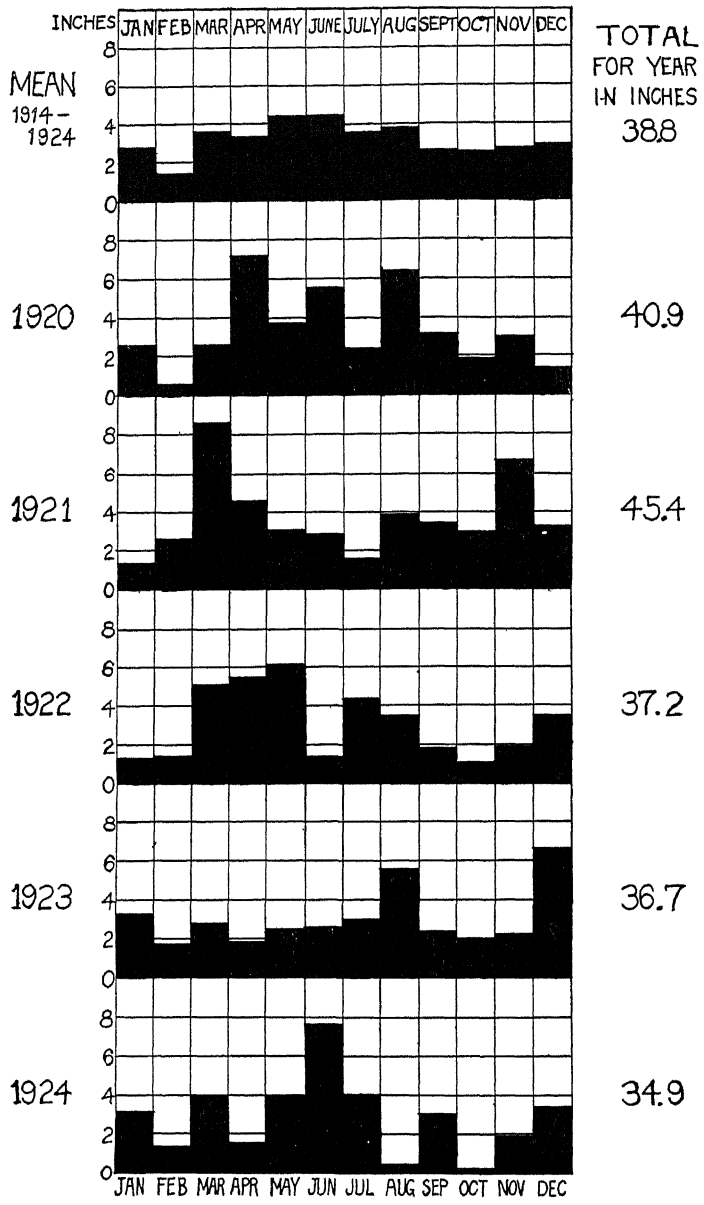

Fig. 2.—Showing the rainfall by months during the five years of this study and the average for the period 1914-1924

There was also an average of 10 acres of bluegrass pasture per farm besides a small woods which was usually good for some pasture part of the year, especially for sheep. The average yield of hay was 1.12 tons.

Rye, soybeans, alfalfa, and miscellaneous crops occupied on the average about one acre each per farm. Those who grew rye generally used it as a cover crop, obtaining early spring pasture from it before plowing it under for corn. Occasionally it was left to be harvested or hogged down. Soybeans, as Table 1 shows, were grown more extensively in 1924 than in any other year. This acreage did not include those grown in the corn. Some practiced planting soybeans with corn for hogging purposes or even to cut with the binder with the corn. Alfalfa was limited to 5 of the 25 farms. There is a tendency to grow more, but it has not become widespread as yet. Miscellaneous crop areas were mostly taken up by small truck patches, a few acres of such catch crops as millet, Sudan grass, and a few fields for clover seed and timothy seed. The average county yields for the five-year period, as reported by the crop reporting service, were: corn, 40 bushels; wheat, 16 bushels; oats, 31 bushels; and hay, 1.3 tons. The farms studied, therefore, were quite representative.

Soil type and drainage.—The prevailing soil type of the region and of the farms studied is Miami clay loam. This type and the closely associated Miami silt loam are the most common soil types of western Ohio, and form the largest portion given to general farming in the State. The topography of the portion studied is level. Drainage is only fair. A small portion has natural drainage, to some extent, by being underlaid with gravel. Most of the farmers depend almost entirely upon tile drainage, which has not been developed to its fullest extent.

Climatic conditions.—Figure 2 shows the rainfall during the five years this study was conducted, together with the average for the 10-year period from 1915 to 1924. The average growing season for 10 years, including the 5 years of this study, was 176 days, as shown by Table 3, during which period 58 percent of the total precipitation fell.

Roads and markets.—The region has good stone and gravel roads suitable at all times for market hauling. Trading points are relatively close together. Few farmers need to haul their grain or produce more than five miles. Trucks, either hired or owned, are used quite frequently for hauling.

Fertility practices.—Approximately 26 percent of the cropped land on the cost account farms was in either first- or second-year

TABLE 3.—Climatic Conditions,* 1920-1924 and the 10-year Average

Item	1920	1921	1922	1923	1924	10-year average 1915—1924
Precipitation, in inches:						
April 1 to September 30	28.52	19.84	22.87	18.07	20.86	22.48
October 1 to March 31	12.34	25.58	14.33	18.65	14.05	16.28
Total annual	40.86	45.42	37.20	36.72	34.91	38.76
Last killing frost in spring	April 14	April 18	April 29	May 10	April 23	April 24
First killing frost in fall	October 30	October 4	October 13	October 6	October 23	October 17
Frost-free days	198	168	167	149	183	176

*U. S. Weather Bureau. Data on precipitation were gathered at Springfield about 15 miles from most of the farms, and frost data at Xenia, within 10 miles of the greater portion of the farms studied.

grass or clover. The sod land plowed under annually amounted to 23 percent of the area cropped. Of this sod 93 percent was first year clover sod. Two farmers followed the practice of sowing soybeans in their corn. Nine different farmers grew this legume. Of the total soybean acreage, 83 percent was grown in 1924. In that year soybeans occupied an average of 14 acres per farm on these nine farms. Alfalfa entered very little into the rotation. Of the four farmers growing this crop, one maintained his field of alfalfa thruout the five years by partially reseeding it once during this time; two farmers plowed theirs under after two seasons; and the other, who had two different fields, cropped each three years and then plowed them under. This was the extent of legumes grown.

TABLE 4.—Relation of Acres per Animal Unit and Fertility Practices to Crop Yields, 1920-1924

Farm number	Acres* per animal unit	Manure hauled per acre†	Fertilizer per acre†	Percent of rotated area in grass	Land value	Yield of crops			Index number of crop yields‡
						Corn	Wheat	Oats	
	No.	*Loads*	*Lb.*	*Pct.*	*Dol.*	*Bu.*	*Bu.*	*Bu.*	
2	1.9	1.9	51	39.7	90.80	53.7	21.9	35.9	154
16	2.3	1.6	73	34.0	90.00	55.7	16.2	.....	135
18	2.5	2.0	66	31.5	95.00	40.3	22.7	38.5	138
19	2.6	.5	39	33.0	72.50	45.4	20.1	24.9	136
1	2.9	1.6	43	25.8	94.75	39.8	20.0	.....	127
3	2.9	.9	13	28.8	87.50	37.7	.....	27.4	104
13	3.0	1.8	71	36.1	105.00	51.7	23.4	.....	156
7	3.1	.7	47	29.0	90.00	44.5	20.0	31.2	134
6	3.3	1.5	63	29.0	80.00	38.4	16.0	.....	111
17	3.5	1.0	50	32.2	80.80	50.4	16.9	22.8	130
14	3.6	.6	63	31.4	87.50	47.1	18.3	29.3	127
15	3.6	1.9	38	28.4	96.00	48.1	20.8	.....	142
12	3.7	1.1	92	30.4	83.00	46.0	21.4	39.1	141
4	4.0	.3	0	35.0	90.00	42.5	.....	29.7	117
11	4.1	1.7	86	32.2	85.00	50.2	23.2	17.0	153
9	4.3	1.4	0	17.0	104.00	49.6	.....	29.7	136
20	4.3	.6	48	39.1	79.00	36.4	13.8	68.6	100
8	4.4	.9	60	39.7	97.00	41.9	18.6	36.7	125
5	6.4	.4	0	22.3	87.00	44.6	.....	32.9	123
10	7.0	.8	82	26.7	82.10	39.6	17.3	.....	117

*Acres excluding waste land.
†Applied on rotated area per year.
‡Index of corn and wheat yields, using the lowest yield of each year as base of 100.

There was considerable variation in the amount of livestock kept and manure produced. Acres of land, excluding waste, per animal unit varied from 1.9 acres for the five-year period on the most highly stocked farm, to 7.0 acres per animal unit on the lowest stocked farm. This means a considerable variation in the percentage of the crops fed and the amount of manure produced on the farms. The average number of loads of manure hauled each year per acre of rotated land was 1.1, (averaging 1 ton per load), or an average of 3.6 loads per animal unit, varying on the different farms from 1.2 loads to 5.5 loads per animal unit, according to the feeding and pasturing practices and to the amount and kind of livestock kept. This may appear to be a small amount of manure per animal unit, but is explained by the fact that fully one-half of the livestock units on the average farm in this area was hogs, from which very little manure is recovered. Those farms with a large proportion of cattle hauled out more loads of manure per total animal unit than those whose livestock consisted chiefly of hogs.

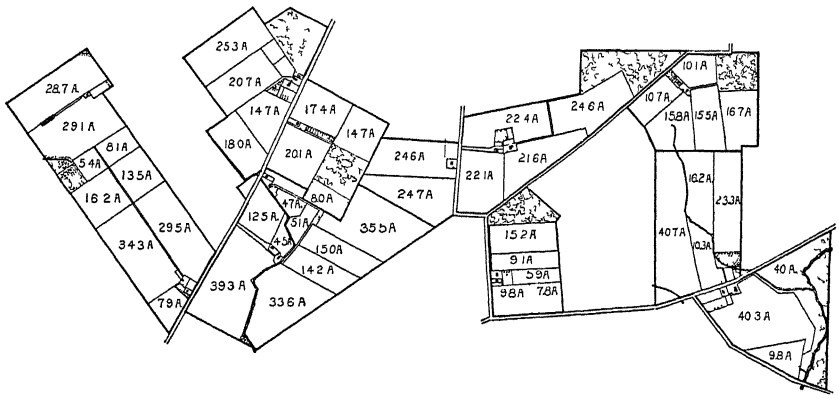

Fig. 3.—Showing location and plan of farms in this study.

Nearly all of the manure was spread on the sod land to be plowed under for corn. The bulk of it was hauled from July to September. The time of hauling depended upon the time available. There was an average of 147 loads of manure hauled per farm per annum, with an expenditure of 1.12 man-hours and 1.90 horse-hours per load.

BASIC FACTORS OF COST

Basic cost factors, such as hours of man-labor and horse-labor, hours of tractor work, amounts of fertilizer and manure, quantities of seed, twine, and other materials necessary for the production of

farm crops, are desirable measures in cost-of-production studies but they do not tell the whole story. Factors such as insurance, taxes, equipment charge or machinery costs, and overhead charges are given in terms of dollars and cents and form a substantial portion of the total cost of any farm product.

The aim of this study is not merely to show the factors and their material quantities that enter into the cost of producing the various farm crops; but, from the variations of these factors from farm to farm also by contrasting the efficient means and methods of the low-cost producers with those of the high-cost producers, to show the factors that increase costs, and methods of gaining efficiency and lower costs of production. This is more clearly shown if all factors are reduced to a common base—namely, dollars and cents. Material quantities are also given and can be used together with prevailing rates at any time to arrive at an estimated cost of production.

Labor and power factors.—The cost of hired labor was arrived at by taking into account all considerations given to hired labor, such as use of house and garden, keeping of cow or horse, meat or coal furnished, board, fruit, and potatoes, as well as wages. All labor of the operator was taken at 30 cents per hour, this being an average of 10 percent above that of all hired labor. This was merely to compensate for a higher class of labor and in no way to act as payment for the farmer's managerial ability.

The horse work cost used was the actual cost as calculated each year for each farm. Feed was the main item of cost. Other items entering into horse-labor costs were man-labor, building charges, equipment charges, interest, depreciation, taxes, insurance, shoeing, veterinary services, and miscellaneous costs. From this total, manure credits were taken and the net cost divided by the number of horse-hours of work. The average cost of horse work on all farms from 1920 to 1924 was 16.3 cents per horse-hour.

Tractor costs were likewise calculated each year by considering all the various factors that enter into the cost of tractor work. This was calculated on the basis of hours used and averaged 95 cents per hour.

Material requirement factors.—Cost of seed was figured at the purchase price if the farmers bought it, or at the market price for such quality of grain as was used for seed. Labor for recleaning, shelling, testing, and all like labor was charged directly against the crop benefited.

Manure charges include the value of manure at the barn or feed lot plus all costs of hauling to the field, a charge for the use of the spreader being added as part of the cost of hauling. In calculating manure and fertilizer charges for each crop, 50 percent was charged to the first crop, 30 percent to the succeeding crop, and 20 percent to the third crop.

Coal for threshing and shredding, and twine were charged at purchase price directly to the crops benefited.

Other cost factors.—Equipment charge includes the repairs, depreciation, and other items that enter into the maintenance of equipment and machinery used for productive purposes on the farm. The total annual charge was prorated to the productive crop and livestock enterprises on the farm in proportion to the number of horse-hours of work required for their production and maintenance.

Taxes as they appear in this study are only the taxes on real estate. Taxes on equipment and livestock were charged directly to those accounts.

Overhead expenses include interest on the value of the land in roads, lanes, and farmstead; labor and other expenses for fence maintenance; telephone rent; weed control; and other expenses which are so general that they cannot be charged directly to any single farm enterprise. These have been grouped and prorated to all productive crop and livestock enterprises in proportion to the man-hours devoted to these enterprises.

Threshing machine and shredding charges appear in the cost tables as such and represent the actual charges made for these operations. Where no charge for fuel appears in its respective column, the charge is included with the machine charge. This is the custom where tractors are used for power.

Interest that appears as such in these cost tables represents 6 percent interest on the value of the land. It is contended by some that interest is not a cost of production. Others consider it a cost whether paid or not. Some enterprises, however, require more capital investment than others. Interest on the value of land therefore has been kept separate and cost figures per unit are given both with and without interest on the value of the land included, so that one who desires to recalculate the data in some other way may easily do so. Interest on the investment in equipment is taken care of in equipment charge, and interest on building investment is included in the building charge which is prorated to those enterprises that are benefited by the buildings. While the records were

started on January 1, 1920, the values placed on real estate were those of the year 1924. The high land values of the war period do not therefore enter into the costs.

Any figure which pretends to show the total cost of production involves some estimates. While estimates have been used, the endeavor has been to make them as few as possible and to check them as accurately as possible.

Credit factors.—In calculating the cost of harvesting corn, credit is given for the value of the fodder. Where corn was husked from the stalk, credit is given only for the value of the pasture obtained from the standing stalks. Likewise the cost of producing wheat or oats is credited with the value of the straw. Its value is determined by the market value on the farm. The data on the cost of harvesting corn shows the importance of the complete utilization of the by-products if the costs of production are to be kept at their lowest.

Hay was not made for the purpose of selling but principally for use as feed on the farm. Grass land for hay was often pastured some before the hay was made. In order to give the grass land credit for what it produced, credit for pasturing before or after hay was made is deducted from the cost of producing hay.

VARIATIONS IN COST OF CROP PRODUCTION

A statement of the cost on any group of farms will show a wide range in the net cost. The character of the land, fertility practice, system of operation, and the weather are all factors which contributed to these variations. Probably the weather, which influences yield, had more to do with variation in cost from year to year than any other one thing. The weather cannot be controlled, yet there are many factors which influence costs which can be controlled and there are practices which may even to some extent mitigate the influence of bad seasons. The value of cost of production figures is not that they seem to show that wheat or corn costs a certain amount per bushel, but rather why it costs that amount and the various factors that affect the cost. Using these cost figures as somewhat of an index of the efficiency with which the crop was produced on the different farms, it is aimed in this bulletin to point out some of the factors which influenced the costs of crop production on these Greene County farms.

Due to the wide variation in methods of harvesting it has been thought best to present corn-growing costs up to the time of harvesting in a separate table. Harvesting costs are given in following tables.

CORN

COST OF GROWING UP TO HARVEST

Causes for farm-to-farm variations.—The variation in the cost of producing corn up to harvest as shown in Table 5 ranged from 34 to 57 cents per bushel. Farm 14 had the lowest cost per acre as well as per bushel. This was mainly due to the small amount of labor used. Large labor units were used where possible. Three- and five-horse teams were used for plowing and three-horse teams for cultivating. The manure and fertilizer charge per acre was low as very little manure was hauled and no fertilizer was used directly on corn. The land was naturally good corn land, which kept the yield above the average.

TABLE 5.—Corn: Variations in Cost of Growing up to Harvesting, 1920-1924

Farm number	Labor per acre			Cost per acre						Yield per acre	Cost per bu.	
	Man	Horse	Tractor	Total labor*	Manure and fertilizer	Miscellaneous †	Taxes on land	Interest on land	Total		Excluding interest	Including interest
	Hr.	*Hr.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*	*Dol.*	*Dol.*
14‡	8.97	28.30	.....	6.05	1.33	1.92	1.27	5.40	15.97	47.1	0.22	0.34
4	9.17	25.25	0.79	7.22	.79	1.63	1.61	5.40	16.65	42.5	.26	.39
2	11.21	30.80	.....	8.73	3.58	2.15	1.45	5.51	21.42	53.7	.30	.40
9	14.69	33.11	.14	9.28	1.94	1.74	1.36	6.26	20.58	49.6	.29	.41
5	13.86	35.82	.05	9.76	1.12	1.88	1.17	5.22	19.15	44.6	.31	.43
13‡	12.97	35.42	.....	7.43	4.85	2.70	1.47	6.30	22.75	51.7	.32	.44
12‡	11.37	17.13	2.86	8.93	2.91	2.77	1.22	4.98	20.81	46.0	.34	.45
7	10.73	29.90	.10	9.20	2.24	2.71	1.21	4.89	20.25	44.5	.35	.45
19§	14.71	37.91	.....	10.45	1.93	3.49	1.22	4.35	21.44	45.4	.38	.47
16‡	16.27	42.95	.....	12.89	4.02	3.12	1.11	5.40	26.54	55.7	.38	.48
17‡	11.82	35.24	.....	11.75	3.10	3.48	1.15	4.85	24.33	50.4	.39	.48
10	11.75	24.72	.82	7.61	2.76	2.71	.88	4.98	18.94	39.6	.35	.48
15‡	14.83	33.19	.36	8.05	5.22	2.74	1.91	5.76	23.68	48.1	.37	.49
1	8.13	11.35	3.03	7.29	3.46	2.43	1.32	5.25	19.75	39.8	.36	.50
11	13.90	35.21	.....	10.23	5.31	2.83	1.49	5.10	24.96	50.2	.40	.50
8	11.29	27.06	.37	8.37	3.01	2.49	1.54	5.82	21.23	41.9	.37	.51
3	10.11	22.52	1.43	8.88	1.99	1.98	1.11	5.25	19.21	37.7	.37	.51
20**	10.89	32.33	.....	8.73	2.18	2.81	1.05	4.74	19.51	36.4	.41	.54
18§	8.87	20.35	1.81	7.95	5.19	1.67	1.38	5.70	21.89	40.3	.40	.54
6	13.53	34.10	.....	10.88	3.19	1.77	1.15	4.80	21.79	38.4	.44	.57
Av.	12.38††	34.10	.....	8.67	2.90	2.35	1.32	5.33	20.55	45.0	.34	.46
	9.38‡‡	19.27	1.95									

*This includes cost of man and horse labor and tractor work.
†Miscellaneous costs includes seed costs averaging 19 cents, equipment charge averaging $1.46, and an overhead charge averaging 79 cents.
‡Four year records collected on farms number 12, 13, 14, 15, 16, and 17.
§Three year records collected on farms number 18 and 19.
**Two year records collected on farm number 20.
***Five year records collected on farms, unmarked, numbers 1 to 11 inclusive.
††Average labor of those using no tractor labor.
‡‡Average labor of those using some tractor labor.

Farm 4, which ranks second in efficiency of production, is very similar to Farm 14. Gang plows were used, either with five horses or with a tractor, and two-row cultivators with three horses. As man labor for plowing and cultivating was 67 percent of the total amount of labor used in producing corn up to harvesting, any labor saved by using large units with these operations materially reduced the cost of production. Farm 4 used no fertilizer for any crop grown and very little manure was hauled; the manure charge was, therefore, low. Even with only an average yield, a low cost of production per bushel was secured because of this low cost per acre. It is probable that more manure or fertilizer would have increased the yield and still have maintained a highly efficient production.

Farm 2 had above average cost per acre but because of the exceptionally good yield was able to produce corn at a low cost per bushel.

Farm 19 spent more time plowing than any other farm, as shown in Table 27 more than a fourth of the plowing was done with a two-horse team, but three horses were used for the rest. More time than usual was spent dragging and hand-replanting. Farm 19 had the highest overhead charge of any of the farms. This is included in the miscellaneous item and amounts to $1.62 per acre. Numerous business trips made in the automobile, which could not be charged to any one enterprise, form the largest portion of this overhead cost.

Farm 16 had the highest labor costs and the highest acre cost as well as the highest yield. As shown in Table 27, a large amount of time was spent in plowing and cultivating. Over 25 percent more labor was used in these operations than the average for all farms. The high manure and fertilizer charge was not due so much to the quantity applied as to the way the manure was applied and the kind of fertilizer used. Thru the winter and spring months manure was often hauled to the field on a sled and scattered by hand. The fertilizer used consisted of relatively high priced mixed fertilizers. The miscellaneous costs which include cost of seed, equipment charges, and overhead charges, were high. All three of these items were higher than they should have been and serve to make the cost per bushel about the average in spite of the high yields.

Farm 17 had the second highest labor costs. While the number of hours of labor used was not high, the rate charged for man-labor was highest of any of the farms. The average rate for man-labor for all farms was 28.8 cents per hour, while on Farm 17 the

labor was charged at 32.7 cents per hour. As all the operator's labor was charged at 30 cents per hour, the hired labor was much higher than that, due partly to the cost of maintaining a tenant house for the hired man, built at a cost of $3,000. Miscellaneous costs were high because of a high equipment charge. Much time was spent in repairing old machinery, and the building charge for housing the machinery was high.

Farm 11 had a yield much above the average, but the high labor and fertilizer cost resulted in a relatively high cost per bushel. The high labor cost was due to the large amount of labor used in plowing and also to the high hourly cost of man and horse-labor. Larger units in plowing would have reduced the labor cost per acre.

Farm 3 had a relatively high cost per bushel mainly because of the exceptionally low yield. All cost factors were low, however. Manure and fertilizer charges were very low. The yield could undoubtedly have been increased very profitably by applications of manure and fertilizer.

Farm 20 kept records for only two years, 1923 and 1924, when all yields were below normal.

Farm 18 kept records for only three years, 1922-1924, which were the poorest of the five years for corn yields. This farm has soil that will produce more than an average of 40 bushels of corn per acre. All costs were moderate with the exception of manure and fertilizer. More manure was hauled on this farm than any other. An average of 2.8 loads per acre was hauled for corn. Part of this was hauled quite a distance which accounts for part of the high manure charge.

Farm 6 used a large amount of labor with a corresponding increase in cost of production. Three horses were used for plowing but only two were used in cultivation. Besides using a one-row cultivator, the corn was cultivated four or more times, which was more than on any other farm in the group. This large amount of time spent at cultivation did not seem to bring about any corresponding increase in yield.

It is evident that a low cost of production per bushel goes along with a low cost per acre and a high yield, while a high cost of production per bushel goes along with a high cost per acre and a low yield per acre.

COST OF HARVESTING CORN

Several methods were used for harvesting corn. About 55 percent of the corn was cut, 28 percent was husked from the stalk, and 17 percent was hogged down, a portion of which was sown in

wheat. On no farm was all the corn harvested by a single method. As to further methods of harvesting: 41 percent of the crop was husked from the shock, 8 percent was shredded, 4 percent was fed in the shock, and 2 percent was put into the silo. To secure the relative costs of the different methods it will be necessary to analyze the costs of each method separately.

TABLE 6.—Corn: Variations in Cost of Cutting and Shocking by Hand, With Regular Farm Labor, 1920-1924

Farm number	Man-labor per acre	Cost per acre		
		Labor	Twine	Total
	Hr.	*Dol.*	*Dol.*	*Dol.*
6	6.55	1.97	0.08	2.05
15	7.45	2.01	.06	2.07
8	7.16	2.08	.06	2.14
4	8.06	2.42	.07	2.49
3	8.09	2.42	.09	2.51
11	8.45	2.48	.06	2.54
13	8.60	2.72	.06	2.78
Average	7.86	2.32	.07	2.39

Cutting corn by hand.—Of the corn 73 percent was cut by hand either by the operator and the regular hired labor at the regular wage, or by extra contract labor cutting by the shock. That cut by the latter method was 50 percent; with the binder, 27 percent. Thus only 23 percent of the corn cut was cut by hand by the operator or the regular labor working at the regular wage.

TABLE 7.—Corn: Variations in Cost of Cutting and Shocking by Hand With Contract Labor Paid by the Shock, 1920-1924

Farm number	Cost per acre		
	Labor	Twine	Total
	Dol.	*Dol.*	*Dol.*
6	5.00	0.08	5.08
15	4.75	.06	4.81
8	4.51	.06	4.56
4	4.50	.07	4.57
3	5.00	.09	5.09
11	5.25	.06	5.31
13	4.25	.06	4.31
Average	4.75	.07	4.82

It is a common practice in this section for the regular labor to be allowed to cut corn at the contract rate per shock. For the period of the study the average contract rate for cutting corn was 19 cents per shock of 144 hills. Thus in Table 6 most of the labor reported was the labor of the operator charged at 30 cents per hour.

The difference in cost of harvesting as shown in Tables 6 and 7 was due largely to the difference in the labor rate charged, the average wage earned by contract labor cutting corn by the shock being twice as much as the rate paid for regular labor thruout the year.

Cutting corn with binder.—The remaining 27 percent of the corn cut during the five years was cut with a binder. That the practice is growing in favor is shown by the following figures giving the percentage of the corn cut which was cut by the binder each year: 1920, 13 percent; 1921, 16 percent; 1922, 23 percent; 1923, 31 percent; 1924, 43 percent. As shown by Table 8, Farms 6, 18, and 20 had the lowest cost in cutting corn with the binder. They used three horses all or most of the time. Farm 17 did some hand cutting along with that of the binder, which increased somewhat the man-labor for cutting. His rate paid for regular labor was higher than any of the others, which also increased his cost per acre.

TABLE 8.—Corn: Variations in Cost of Cutting With a Binder and Shocking by Hand, 1922-1924

Farm number	Labor per acre			Cost per acre			
	Cutting		Shocking	Total labor	Twine	Equipment	Total
	Man	Horse	Man				
	Hr.	*Hr.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
20	1.91	4.24	2.21	1.92	0.32	0.80	3.04
1	2.24	4.48	5.28	2.63	.20	.31	3.14
18	1.90	3.33	4.59	2.37	.27	.50	3.14
7	2.11	4.22	2.68	2.24	.28	.67	3.19
6	1.69	4.95	3.50	2.55	.25	.53	3.33
14	2.23	4.86	3.24	2.12	.25	1.02	3.39
17	2.51	4.69	2.32	2.47	.25	.93	3.65
Average	2.01	4.47	3.28	2.35	.26	.67	3.28

As shown by Table 8 the charge on equipment had a wide variation and its effect on the total cost is noticeable. The figures show that the total cost per acre of cutting corn with a binder and putting it in the shock was more than when cutting it by hand, if all labor is charged at the average rate for hired labor. The advantage of this method is in getting the work done with a saving of two and one-half hours of man-labor per acre. With the scarcity of farm help this factor is becoming of increasing importance. The cost of horse-labor, which was charged against cutting corn with the binder, should probably be somewhat discounted as there was no other work for the horses at that time. If we compare the cost of

cutting corn with a binder with that of cutting by hand using contract labor paid by the shock, which was the more usual method, the cutting with the binder was much more economical. Very few farmers were able to cut their crop without the help of extra hired labor, which makes this comparison the one most applicable.

Husking corn from the stalk.—Twenty-eight percent of the corn was husked from the stalk. Some of the farmers made a practice of husking nearly all their corn by this method, while others only occasionally husked some by this method. Those who followed the practice said that it saved the labor of cutting the corn and also some labor in husking. The stalks were afterwards pastured to some extent and oats were sown in the spring, or the field was plowed again for corn. Oats straw and hay supplemented the corn stalks for roughage.

TABLE 9.—Corn: Variations in Cost of Husking and Cribbing From the Stalk, 1920-1924

Farm number	Labor per acre		Corn husked and cribbed per hour	Gross cost per acre			Pasture credit per acre	Net cost per acre	Yield per acre	Cost per bushel	
	Man	Horse		Total labor	Equipment	Total				Without pasture credit	With pasture credit
	Hr.	*Hr.*	*Bu.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*	*Dol.*	*Dol.*
1	11.32	17.90	4.2	5.41	0.82	6.23	1.84	4.39	48.0	0.13	0.09
4	7.73	13.98	5.7	4.47	.35	4.82	.88	3.94	44.2	.11	.09
9	8.39	15.95	6.4	4.77	.39	5.16	.45	4.71	53.8	.10	.09
3	7.39	12.41	3.3	4.70	.53	5.23	1.06	4.17	39.0	.13	.11
2*	11.71	14.57	4.8	6.01	.95	6.96	.24	6.72	56.0	.13	.12
5	9.08	16.08	5.0	5.24	.42	5.66	.39	5.27	45.3	.12	.12
Av.	8.66	15.03	5.4	4.90	.45	5.35	.75	4.60	46.4	.12	.10

*Farm 2 is an average for three years, 1920, 1921, and 1923.
All others are averages for five years.

The variations shown in the cost of husking corn from the stalk were mainly due to differences in the efficiency of the labor, the amount of credit given for pasturing the stalks, and the yield of corn. In Table 9, Farms 1, 4, and 9 were equally low in the per-bushel cost of husking stalk corn over a period of five years, each due to different factors. On Farm 1 the amount of corn husked and cribbed per hour of man-labor was next to the lowest, but since the stalks were utilized to the largest extent for feed, the net cost per bushel was low. On Farm 4 a little better than the average number of bushels was husked per hour but credit for pasture was slightly above the average, thus keeping the cost per bushel low. Farm 9, having very low pasture credit but with a good yield and high labor efficiency in husking and cribbing, maintained a low cost

of husking. The cost on Farm 2 was high because the amount of corn husked per man-hour was below average, the rate paid for labor was high, and also the pasture credit was very low. The high cost per bushel on Farm 5 was the result of a high labor rate and low pasture credit.

Husking corn from the shock.—Forty-one percent of the corn was husked from the shock. Man-labor constituted more than eighty percent of the cost of husking and cribbing corn from the shock. If low per-bushel cost is to be gained, it must be thru the man-labor, either in the amount used or the rate paid. The efficiency with which the corn was husked on the various farms, as shown in Table 10, ranged from 3.1 to 4.1 bushels per man-hour, 32 percent more corn being husked per hour of man-labor on Farms 15 and 17 than on Farm 10.

Farm 15 was one of the highest in amount of corn husked per hour, but a little below the average in the rate of cribbing. Farm 13 was above the average in the number of bushels husked as well as cribbed per man-hour. Farm 2 was higher than Farm 13 in efficiency of labor at husking and cribbing corn, but having a higher rate for hired labor the cost per bushel was higher than that of Farm 13.

Farms 10 and 6 had high labor costs both in husking and cribbing corn which made their cost per bushel high. Farm 17 was highly efficient in husking corn. This was more than offset by the high rate paid for labor and the large amount of labor used in cribbing, making the cost per bushel high.

The above discussion and Table 10 are based on labor being charged at the rate paid for regular labor. An extra column has been added to the table showing the cost per bushel for husking and cribbing corn from the shock when the labor for husking is charged at the rate paid by the shock or bushel and that for cribbing at the rate paid for regular labor. Very few farmers were able to husk all their corn with their regular labor and many harvested a portion with contract labor which was paid at a certain rate per bushel or per shock. This extra cost should be considered in any harvesting study. When contract labor was used, the increased cost of husking was two cents per bushel on the average.

Husking from stalk versus husking from shock.—It took 7.10 more hours to husk and crib an acre of corn out of the shock than direct from the stalks. This amounted to a saving of 45 percent on man-labor or to a saving of more than 28 days on a 40-acre field. If all or a portion of this labor must be hired, the saving in expense is

TABLE 10.—Corn: Variations in Cost of Husking From the Shock and Cribbing, 1920-1924

Farm number	Labor per acre			Corn husked per hour	Corn cribbed per hour	Corn husked and cribbed per hour	Cost per acre			Yield per acre	Cost of husking per bushel		Cost of husking and cribbing per bushel	
	Husking	Cribbing					Man labor husking	Total labor cribbing	Equipment		Regular labor	Contract labor	Regular labor	Contract labor*
	Man	Man	Horse											
	Hr.	*Hr.*	*Hr.*	*Bu.*	*Bu.*	*Bu.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
15	11.87	3.17	4.59	4.1	15.2	3.2	3.20	1.42	0.22	48.2	0.06	0.09	0.10	0.13
13	13.82	3.12	5.86	3.9	17.3	3.2	4.36	1.54	.21	54.1	.08	.08	.11	.12
2	13.12	2.82	7.06	4.0	18.6	3.3	3.85	2.07	.31	52.4	.07	.09	.12	.14
11	13.67	3.28	5.15	3.7	15.5	3.0	4.02	1.85	.32	50.4	.08	.09	.12	.14
7	10.87	2.09	4.18	3.7	19.0	3.1	3.15	1.44	.45	49.6	.08	.13	.12	.17
8	9.95	2.62	5.19	3.7	14.1	2.9	2.89	1.67	.23	39.8	.08	.12	.13	.16
10	15.08	3.03	4.99	3.1	15.5	2.6	4.29	1.61	.23	36.8	.09	.10	.13	.14
6	12.99	2.71	5.33	3.2	15.4	2.7	3.90	1.87	.31	47.1	.09	.11	.14	.16
17	12.22	3.58	7.34	4.1	13.9	3.1	4.00	2.56	.20	41.7	.08	.09	.14	.15
Av.	12.85	2.91	5.57	3.6	16.0	3.0	3.78	1.80	.27	46.6	.08	.10	.13	.15

Farms 2, 6, 10, and 11 are averages for five years; farm 8 is an average for four years; and farms 7, 13, 15, and 17 are averages for three years.
*Labor for husking charged at rate for contract labor, labor for cribbing at rate for regular labor.

not small. More horse-labor was required when husking from the stalks, as usually each husker had a team, but sometimes there were two men to each team. Horse-labor was not so expensive as man-labor and was usually obtainable on the farm at husking time, while it was often difficult to secure more man-labor. A man husked and cribbed in an hour 80 percent more corn from the stalks than from the shock, and the total cost per bushel was from 23 to 33 percent less, according to the wages paid for man-labor.

The stover is a minor item of consideration yet it influenced the profit or loss on the corn crop as a whole, and its value should have some influence upon the method of harvesting employed. Assuming that the corn was cut to secure the fodder, the following computation would give some idea of the cost of the stover, based on the assumption that all expenses of cutting and husking corn over and above that of husking from the stalk should be charged against the stover. If the corn had been cut and husked by hand, half by regular labor and half by contract labor paid by the shock, the costs would be $3.65 per acre for cutting, $6.32 for husking and cribbing, and $3.58 the actual cost on the farms of hauling an acre of stover to the barn or feed lot. This would have made a total cost of $13.65 per acre. The cost of husking and cribbing an acre of corn from the stalk was $5.35 per acre without giving any credit for stalk pasture. This would have given a difference of $8.20 ($13.55—$5.35) in the cost of harvesting by the different methods. The average yield of stover was a ton to the acre. The cost of stover at the barn as feed was, therefore, $8.20 per ton. Compare this for feeding purposes with the value of hay in the barn, which averaged $12.50 per ton during the period of the study. According to Henry and Morrison's "Feeds and Feeding," corn stover is worth only one-third as much as mixed clover and timothy hay when fed to cows. On the basis of this comparison, therefore, a farmer would not be justified in spending the extra cost of cutting and husking from the shock merely to get the stover to feed, unless hay were unusually high in price.

Several factors, however, would have to be taken into consideration in choosing the harvesting method to employ. If wheat is to be sown the corn stalks must be removed, and wheat on the average has proved more profitable to grow than oats in this region. The hauling of the fodder to the barn, for which a charge of $3.58 per acre was made, is work done during the winter months when time on the farm is not so valuable as the time at harvest. Allowance

should be made for this in the above calculation. In many instances the choice of method would be influenced by the pressure of other work and the amount of farm labor available during the harvesting season.

Another factor to be considered in some sections of the corn belt when methods of harvesting corn are being discussed, is the European corn borer situation. Some have advocated cutting the corn very close to the ground by special attachment to the corn binder. This succeeds in taking off practically ali the stalk, the stover is then put thru the feed lot or otherwise destroyed. But if the stalks have not rotted in the feed lot and are spread out on the fields, the corn borer will not have been controlled by cutting the corn with the special attachments. On the other hand, if the corn is husked off the stalk, the field may be pastured, and then, when the ground is frozen hard, the stalks may easily be dragged and broken off. Later, some dry day, by raking and burning, all borers wintering in the stalks would be destroyed. These operations would come at a time of the year when little other field work could be done, and would so far as now known be as effective a check to the European corn borer as cutting the corn.

Husking corn with a shredder.—About 8 percent of the corn on these farms was husked with a shredder. The variations in cost as shown in Table 11 were from 11 to 15 cents per bushel, these costs including the labor of hauling the shock corn from the field, feeding the shredder, and cribbing the corn. Besides husking the corn, the shredder cuts or shreds the stover and blows it into the mow. In order to get the cost of husking the corn with a shredder, a credit was made for the stover in the mow. This stover credit was calculated by adding the cost of labor for hauling the stover from the field to the barn, and a flat rate of $2 per acre for the increased value due to shredding and putting it into the mow. The net cost of husking with a shredder was secured by deducting the stover credit from the total cost.

The range in costs per bushel for husking corn with a shredder on these ten farms was not wide, as only two farms varied more than one cent per bushel from the average. Labor played an important part in he variations of costs but yield per acre was just as effective. Farms 13 and 11 each used more man-labor than any of the others, but one ranged fifth in the series of costs and the other one ranged tenth. Farm 11 had a higher rate both for man and horse labor and also a slightly lower yield, which placed them in their respective positions.

Farms 3 and 6 had a net cost per acre for husking very near the average, but with low yields per acre their costs per bushel were high.

Farm 10 used more man-labor than the average, but with low shredding machine charges kept the cost per bushel down, even with a low yield. This farm owned an old shredding machine on which only low depreciation charges could be written off.

TABLE 11.—Corn: Variations in Cost of Husking Corn with a Shredder, 1920-1924

Farm number	Labor per acre*		Corn shredded per hour*	Gross cost per acre				Stover credits per acre§	Net cost per acre	Yield per acre	Cost per bushel
	Man	Horse		Total labor	Shredding†	Equipment‡	Total				
	Hr.	*Hr.*	*Bu.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*	*Dol.*
1	10.14	8.57	3.6	3.87	4.10	.39	8.36	4.44	3.92	36.6	.11
17	10.02	14.96	4.5	6.12	3.57	.97	10.66	5.77	4.89	44.7	.11
10	14.41	12.50	2.1	5 97	2.17	.78	8.92	5.68	3.24	30.6	.11
15	10.25	11.28	4.1	4.15	4.67	.54	9.36	4.56	4.80	42.2	.11
13	15.46	17.31	3.4	6.52	5.15	.61	12.28	6.02	6.26	52.6	.12
4	12.53	19.54	3.3	6.78	3.87	.49	11.14	6.18	4.96	41.1	.12
19	13.13	12.37	3.3	5.73	4.44	.56	10.73	5.53	5.23	43.6	.12
6	10.04	9.22	3.6	4.81	4.65	.35	9.81	4.96	4.85	36.2	.13
3	11.31	14.87	3.2	6.36	3.91	.64	10.91	5.92	4.99	35.6	.14
11	15.12	16.78	3.4	7.37	5.58	1.02	13.97	6.53	7.44	51.3	.15
Av.	12.13	13.70	3.4	5.81	3.97	.67	10.45	5.58	4.87	41.1	.12

*Labor includes that of hauling the corn and fodder from the field, feeding the shredder, and cribbing the corn.

†This includes machine hire, or equipment charge on shredding machinery if the machine is owned, and fuel costs.

‡This covers a charge for the use of wagons.

§This covers the cost of hauling stover to the barn (an average of 6 man-hours and 9 horse-hours per acre) and the increased value due to shredding and putting into the mow.

Farms 1 and 11 are averages for five years, and the rest are averages for three years.

Husking corn from the shock with a shredder versus by hand.—In husking corn with a shredder it required on the average 12.13 man-hours per acre, part of which should be charged against the stover. Hauling stover from the field to the barn took on the average 6 man-hours per acre. If this is used as a measure of the portion of the labor to be charged against the stover when the shock corn is hauled in from the field and fed thru the shredder, it leaves 6.13 hours applicable to the husking of corn. In comparing this with the man-labor required for husking by hand and cribbing, which took 15.76 hours per acre, there would be a difference of 9.53 hours. The man-labor for shredding was usually supplied by exchanging with neighbors; when a farmer secured additional labor to husk corn by hand he paid considerably more than regular labor would cost him. At least half of the corn husked by hand was husked by contract labor. The average total cost of husking by hand, when half of the corn was husked by contract labor and half

by regular labor, was $6.32 per acre. The average net cost when the corn was husked by a shredder, including cost of man- and horse-labor, shredding machine charges and fuel, charges for the use of the wagons, less amount chargeable to the stover, was $4.87 per acre, making a difference of $1.45 per acre in favor of the shredder. If only regular labor had been used for husking by hand, the difference would have been 98 cents, while if contract labor alone had been used, the difference would have been $1.92 per acre, both in favor of using the shredder.

Husking corn with a shredder would seem to be more efficient in the use of labor than husking by hand. It will be noted that the total time required for shredding was about the same as that for husking from the shock. With shredding, however, the corn was in the crib and the stover in the mow; while with husking, the stover and husked corn were in the field. On the average they husked and cribbed at the rate of 3 bushels per man-hour when the corn was husked by hand, as against 6.7 bushels per man-hour when it was husked by a shredder. This shredding rate was derived by deducting from the total time (12.13 hours) required per acre, a credit of six hours, which was the time normally spent in hauling in stover. This is an increase of 123 percent in the efficiency of man-labor brought about by the use of a shredder.

Harvesting corn by different methods.—The total cost of harvesting corn varied from 10 to 18 cents per bushel, according to the method of harvesting and kind of labor used, as shown in Table 12.

Husking corn from the stalks had the lowest cost because it required the least amount of man-labor of any method considered. The most expensive method of harvesting corn was cutting it by hand and husking from the shock when the labor for cutting was paid by the shock and for husking by the shock or bushel. The average cost by the above method was 18 cents per bushel, when $3 per acre was allowed as a credit for the stover. This amount represented the market value of the stover in the field. The cost of cutting and husking by hand was very materially lowered when a binder was used in place of contract labor to cut the corn. Where the regular labor was used in cutting the corn with a binder and husking, the cost was 13 cents per bushel; but where regular labor was used for cutting with the binder, shocking and cribbing, and labor paid by the shock or bushel for husking the corn, the cost was increased to 15 cents per bushel.

TABLE 12.—Corn: Variations in Cost of Harvesting by Different Methods, 1920-1924

Method	Labor per acre		Corn husked and cribbed per hour	Gross cost per acre					Pasture or stover credit per acre	Net cost per acre	Yield per acre	Cost per bushel
	Man	Horse		Man labor	Horse labor	Twine	Equipment	Total				
	Hr.	*Hr.*	*Bu.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*	*Ct.*
Husked from stock*	8.66	15.03	5.4	2.54	2.36	.....	0.45	5.35	0.75	4.60	46.4	9.9
Cut by binder and husked from shock*	21.05	10.14	3.0	6.23	1.70	0.26	.94	9.13	3.00	6.13	46.6	13.2
Cut by binder and husked from shock†	21.05	10.14	3.0	7.18	1.70	.26	.94	10.08	3.00	7.08	46.6	15.2
Cut by hand and husked from shock*	23.62	5.57	3.0	6.97	.93	.07	.27	8.24	3.00	5.24	46.6	11.2
Cut by hand and husked from shock‡	23.62	5.57	3.0	10.34	.93	.07	.27	11.61	3.00	8.61	46.6	18.4
Cut by hand and shredded*	19.99	13.70	6.7**	5.91	2.22	.07	4.64	12.84	8.58	4.26	41.1	10.4
Cut by hand and shredded§	19.99	13.70	6.7**	8.34	2.22	.07	4.64	15.27	8.58	6.69	41.1	16.3
Cut by binder and shredded*	17.42	18.27	6.7**	5.14	3.02	.06	5.31	13.73	8.58	5.15	41.1	12.5

*Labor charged at average rate paid for regular labor.
†Labor for husking charged at contract price paid, other labor at average rate for regular labor.
‡Labor for cutting and husking charged at contract price paid, cribbing labor at average rate for regular labor.
§Labor for cutting charged at contract price.
**Time required to haul stover deducted from total time.

STANDARD REQUIREMENTS

For growing corn.—Standard requirements for the growing of corn are shown in Table 13. They represent the accomplishment of those farmers who handled their labor most efficiently as measured by their ability to perform the various operations with the least hours of labor. These standard requirements furnish a standard of attainment for all farmers to use as their guide. Attainments with different size implements are given to show the relative efficiency in getting over the ground.

TABLE 13.—Corn: Standard Requirements for Growing

Operation and implement used	Labor per acre		Acres covered in 10-hour day
	Man-hours	Horse-hours	
Plowing, 2-14-in. gang and tractor	1.3		7.7
Plowing, gang and 5 horses	2.0	10.0	5.0
Plowing, sulky and 3 horses	3.3	10.0	3.0
Plowing, 2 horses	5.5	11.0	1.8
Dragging, 10-foot, 4 horses	.7	2.8	14.0
Discing, 7-foot, tractor	.5		20.0
Discing, 7-foot, 4 horses	.7	3.0	13.3
Harrowing, 12-foot, 3 horses	.5	1.6	18.2
Planting	.6	1.2	16.4
Cultivating, 2-row, 3 horses	.7	2.1	14.0
Cultivating, 1-row, 2 horses	1.3	2.6	7.4

Required 8.9 pounds of seed per acre.

If a sulky plow and three horses are used, 66 percent more ground can be plowed in a 10-hour day than if a two-horse walking plow is used. Likewise with a two-bottom gang plow and 5 horses, almost three times as much ground can be plowed, and with a tractor two-bottom gang plow over four times as much ground can be plowed in a 10-hour day as with the two-horse walking plow. By using the larger units of machinery the plowing is not only done in better season but less man-labor is required.

A very decided advantage exists in using a two-row in place of a one-row cultivator. With a two-row cultivator, one man can cultivate 90 percent more corn than with a one-row machine. If a farmer has 60 acres of corn and cultivates at the average rate, it would take 37 days with a one-row cultivator, to go over it three and a half times, the average practice in Greene County, and an extra man must be hired to do part of the work. With a two-row cultivator one man could do the same amount of cultivating in 19 days, a saving of 18 days of man-labor in a very busy season.

For harvesting corn.—The standard amount of man-labor, required for cutting corn with a binder and shocking, is from 38 to 40 percent less than that required when the cutting is done by hand.

The hours per acre for each operation are shown in Table 14. By using three horses with the binder instead of two, 17 percent more corn can be cut in the same length of time.

TABLE 14.—Corn: Standard Requirements for Harvesting

Operation and implement used	Labor per acre		Acres covered in 10-hour day
	Man-hours	Horse-hours	
Cutting, 3 horses	1.3	3.9	7.7
Cutting, 2 horses	1.5	3.0	6.6
Cutting by hand	6.5	.....	1.6
Shocking after a binder	2.5	.....	4.0
Husking from stalk, 1 man and team, 50-bu. yield	6.3	12.6	1.6
Husking from shock, 50-bushel yield	10.0	.....	1.0
Hauling and cribbing, 1 man and team	2.0	4.0	5.0
Picking up corn knocked off by binder, 1 man and team (2.3 bushel per acre)	.7	1.5	13.7
Shredding, 50-bushel yield	10.0	12.0	1.0
Filling silo, (time to cut with binder not included) 7.3-ton yield	17.2	10.0	.6

Materials per acre:
Twine, when corn cut by binder and shocked, 2.1 pounds.
Twine, when corn cut by binder for silo, 1.8 pounds.
Twine, when corn cut by hand and shocked .5 pound.

The effect of efficiency in all operations.—By adding together the standard requirements of the prevailing operations in growing and harvesting corn, as shown in Table 15, a standard for the complete production is obtained.

TABLE 15.—Corn: Standard Labor Requirements for Growing and Harvesting

Operation and implement used	Total labor per acre	
	Man-hours	Horse-hours
Plowing, 14-inch sulky plow, 3 horses	3.3	10.0
Dragging once, with 10-foot drag, 4 horses	.7	2.8
Discing once with 7-foot double disc, 4 horses	.7	3.0
Harrowing once, with 12-foot harrow, 3 horses	.5	1.6
Planting, 3 feet 6 inches, check-row planter	.6	1.2
Cultivating, 3 times, 2-row cultivator, 3 horses	2.1	6.3
Total labor up to harvest time	7.9	24.9
Harvesting method number 1:		
Cutting, binder, 3 horses	1.3	3.9
Shocking	2.5	.....
Picking up ears knocked off by binder	.7	1.5
Husking from shock	10.0	.....
Hauling and cribbing	2.0	4.0
Total labor harvesting, when cut and husked from shock	16.5	9.4
Harvesting, method number 2:		
Husking off stalk	6.3	12.6
Total labor, growing and harvesting by first method	24.4	34.3
Total labor, growing and harvesting by second method	14.2	37.5

TABLE 16.—Wheat: Variations in Cost of Production, 1921-1924

Farm number	Labor per acre			Gross cost per acre										Straw credit	Net cost per acre	Yield		Cost per bushel	
	Man	Horse	Tractor	Total labor*	Manure and fertilizer	Seed	Twine	Fuel and threshing	Equipment	Overhead	Taxes on land	Interest on land	Total			Per acre	Index number †	Excluding interest	Including interest
	Hr.	*Hr.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*		*Dol.*	*Dol.*
13‡	8.64	12.71	.....	3.93	3.94	2.41	0.31	2.12	0.44	0.85	1.47	6.30	21.77	2.74	19.03	23.4	115	0.54	0.81
12‡	9.01	7.47	1.02	4.77	2.74	2.55	.34	1.92	.49	.73	1.22	4.98	19.74	2.23	17.51	21.4	105	.59	.82
2	7.80	10.30	.....	3.67	4.23	2.66	.37	1.97	.34	.41	1.45	5.46	20.56	2.47	18.09	21.9	115	.58	.83
7‡	9.40	14.94	.....	4.62	2.10	3.04	.28	1.98	.82	.48	1.21	4.89	19.22	1.87	17.35	20.0	98	.62	.86
11	10.94	13.88	.....	5.64	4.70	2.54	.38	2.13	.86	.37	1.49	5.10	23.25	2.36	20.89	23.2	121	.68	.90
14§	6.95	10.10	.....	3.18	2.66	3.00	.27	1.64	.52	.24	1.27	5.40	18.18	1.69	16.49	18.3	93	.61	.90
8	6.62	9.66	.....	3.61	2.64	2.60	.30	1.68	.43	.56	1.54	5.82	19.18	2.17	17.01	18.6	97	.60	.91
18§	10.31	14.80	.31	5.66	4.25	2.15	.27	2.02	.53	.62	1.38	5.70	22.58	1.96	20.62	22.7	107	.75	.91
15§	8.88	16.66	.....	4.43	3.14	1.93	.26	1.89	.80	.62	1.91	5.76	20.74	1.77	18.97	20.8	98	.64	.91
1	7.78	11.99	.27	3.99	4.03	2.91	.26	1.75	.55	.60	1.32	6.00	21.41	2.09	19.32	20.0	105	.67	.97
17‡	7.66	10.83	.....	4.56	3.19	2.96	.35	1.50	.71	.62	1.15	4.85	19.89	2.19	17.70	16.9	91	.76	1.04
6	7.32	8.94	.....	3.99	4.21	2.98	.36	1.54	.34	.16	1.15	4.80	19.53	2.29	17.24	16.0	84	.78	1.08
10	10.08	14.33	.35	5.25	3.85	3.16	.30	1.57	.89	.79	.88	4.98	21.67	1.92	19.75	17.3	91	.85	1.14
16‡	7.85	13.65	. ...	4.87	5.09	3.20	.36	1.58	.60	.48	1.11	5.40	22.69	2.25	20.44	16.2	88	.93	1.26
20§	9.25	12.05	....	4.78	4.15	2.21	.26	1.25	.70	.65	1.05	4.71	19.76	1.55	18.21	13.8	65	.98	1.32
Av.	8.31**	12.06**	.....	4.47	3.61	2.69	.31	1.79	.60	.58	1.33	5.38	20.76	2.16	18.60	19.8	100	.67	.94

*Includes cost of man, horse, and tractor work.
†Index number for wheat yields, using as a base of 100 for each year the average yield for that year on all farms.
‡Three-year averages on farms 7, 12, and 13 from 1922, 1923, and 1924, and on farms 16 and 17 for 1921, 1922, and 1923.
§Two-year averages on farm 14 for 1922 and 1924, and farms 15, 18, and 20 for 1923 and 1924.
**Average hours of labor on those farms using horses only.
Note: Four year averages on farms unmarked, 1, 2, 6, 8, 10, and 11. The average yields of those farms from which records were secured for the various years are as follows; 1921, 15.1 bushels; 1922, 18.6 bushels; 1923, 21.9 bushels, and 1924, 20.8 bushels.

This standard, depending on the method of harvesting, is from 28 to 33 percent less than the average amount of labor used per acre. It shows what could be attained if the operator would do each and every operation in the standard amount of time. Many do some operations in standard time while on other operations they fall short of reaching the standard.

WHEAT

COST OF GROWING AND HARVESTING

Causes for farm-to-farm variations.—The cost of growing and harvesting wheat on the different farms varied from 81 cents to $1.32 per bushel, including interest on land, as shown in Table 16. Variation in yields was the outstanding factor affecting the cost per bushel.

Farm 13 had a high net cost per acre but on account of a high yield per acre the cost per bushel was the lowest. Farm 12 had good yields and a very low cost per acre which gave a low cost per bushel. Farm 11 had the highest labor requirements but with high yields the cost per bushel was low.

Farms 8 and 14 had very low charges for manure and fertilizer, which was reflected in their comparatively low yields; yet with their low labor charges and resulting low costs per acre, the per-bushel costs were below average.

Farms 6, 17, and 20 had costs per acre below the average but because of exceptionally low yields their costs per bushel were among the highest. Farm 16 had the highest manure and fertilizer charge; this did not, however, seem to show results in the yields. A larger portion of this charge was due to expense in hauling and spreading manure, part of which was spread by hand.

Yield per acre had the greatest influence on the cost per bushel. Table 16 shows that the five farms having the highest cost per bushel had yields below the average. Of the five farms with the lowest cost per bushel, only one was below average in yield.

STANDARD REQUIREMENTS

For growing and harvesting wheat.—The standard requirements shown in Table 17 are suggested for the production of wheat. As has been stated, they represent the accomplishment of those farmers who handle their labor most efficiently as measured by their ability to perform the various operations with the fewest hours of labor.

By using a three-horse drill in the place of a two-horse drill, 24 percent more ground was sown in the same amount of time. Likewise there was the advantage of using the four-horse binder over the three-horse binder in covering 19 percent more ground in the same length of time.

TABLE 17.—Wheat: Standard Requirements for Production

Operation and implement	Labor per acre		Acres covered in 10-hour day
	Man-hours	Horse-hours	
Discing, 7-foot, 4 horses	0.7	2.8	14.0
Drilling, 7-foot, 3 horses	.9	2.7	11.2
Drilling, 63-inch, 2 horses	1.1	2.2	9.0
Cutting, 8-foot, 4 horses	.6	2.3	17.5
Cutting, 7-foot, 3 horses	.7	2.0	14.7
Shocking, 22-bushel yield	1.1	.....	9.2
Shock threshing, 22-bushel yield	3.2	3.9	3.1
Barning,* 22-bushel yield	3.1	3.0	3.2
Barn threshing, 22-bushel yield	1.9	.2	5.4

Materials per acre: Seed, 1.9 bushels; twine, 2.4 pounds.
*Hauling in from shocks and storing in mow.

The average amount of seed sown was 1.9 bushels per acre, with a range of from 1.7 to 2 bushels per acre, as shown in Table 33. The amount of twine used varied from 1.7 to 2.8 pounds per acre with an average of 2.4 pounds. Those farms with the larger yields used the most twine.

TABLE 18.—Wheat: Standard Labor Requirements for Production

Operation and implement used	Total labor per acre	
	Man-hours	Horse-hours
Discing, 7-foot double disc, 4 horses, (half of field)	0.4	1.4
Drilling, 7-foot drill, 3 horses	.9	2.7
Cutting, 8-foot binder, 4 horses	.6	2.3
Shocking	1.1	.....
Shock threshing	3.2	3.9
Total	6.2	10.3

By adding together the standard requirements of the prevailing operations in growing and harvesting wheat, as shown in Table 18, a standard for the complete production is obtained. This standard is 25 percent less than the average amount of man-labor required per acre. It shows what could be attained if the operator would do each and every operation in the standard amount of time.

OATS

COST OF GROWING AND HARVESTING

Greene County, where these records were collected, is too far south for the best oats production. On the farms included in the study, an average of 9 percent of the rotated area was in oats. The crop is thus of minor importance in this section. However, on Farms 3, 4, 5, and 9 no wheat was grown, but oats made up 25 percent of their rotated area.

Causes for farm-to-farm variations.—As with wheat, the yield per acre had the greatest effect on the cost per bushel for growing and harvesting oats. Table 19 shows that the yields ranged from 17 to 68.6 bushels per acre. These yields, however, do not represent the average of identical years on each farm. As shown in the footnote to Table 19, the average yield for each year of the five years had a wide variation. Labor averaged more than 26 percent of the gross cost of production.

Farm 20 had the highest yield per acre and also the lowest cost per bushel. Records were secured on this farm for only two years, which included one year of exceptionally good yields. This average yield of 68.6 bushels, which is over twice as large as the average of all farms, was due to growing Fulghum oats instead of the common varieties of white oats. Considerably more labor was required in producing oats on this farm than the average, but this increase was due to more labor required in harvesting and threshing.

Farm 5 had the lowest labor requirement, which together with low cost of other factors, resulted in the lowest net cost per acre. With a little better than the average yield the cost per bushel was among the lowest. The low labor requirement was the result of efficiency in all operations, as is shown in Table 33.

From 11 maintained costs very close to the average, but with an unusually low yield the cost per bushel was the highest. This farm raised oats only two years during this study, and they happened to be poor yielding years. However, the yield of this farm was below the average of all farms for those years.

STANDARD REQUIREMENTS

For growing and harvesting oats.—The standard requirements shown in Table 20 are suggested for the production of oats. Discing for oats is a little slower than discing for wheat, on account of the ground's being heavier with moisture.

TABLE 19.—Oats: Variations in Cost of Production, 1920-1924

Farm number	Labor per acre			Gross cost per acre										Straw credit per acre	Net cost per acre	Yield per acre	Cost per bushel	
	Man	Horse	Tractor	Total labor	Manure and fertilizer	Seed	Twine	Threshing	Fuel for threshing	Equipment	Overhead	Taxes on land	Interest on land	Total				Excluding interest	Including interest
	Hr.	*Hr.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Bu.*	*Dol.*	*Dol.*
20*	13.61	17.64	.....	7.02	1.51	1.84	0.47	3.43	0.74	1.03	0.95	1.05	4.80	22.84	2.31	20.53	68.6	0.23	0.30
5§	6.68	11.56	.....	3.81	.61	2.03	.29	1.65	.17	.30	.37	1.17	5.22	15.62	1.62	14.00	32.9	.27	.43
12*	10.23	8.08	1.67	5.82	1.33	2.03	.29	1.96	.14	.53	.83	1.22	4.98	19.13	2.18	16.95	39.1	.31	.43
8†	7.90	15.37	.....	4.97	1.35	1.78	.27	1.84	.16	.68	.66	1.54	5.82	19.07	1.75	17.32	36.7	.31	.47
2†	8.03	12.63	.....	4.59	2.90	1.81	.35	1.80	.26	.56	.42	1.45	5.26	19.40	2.18	17.22	35.9	.34	.48
4§	7.30	10.16	.23	3.92	.58	2.52	.29	1.49	.17	.26	.57	1.61	5.40	16.81	1.98	14.83	29.7	.32	.50
7‡	8.65	13.30	.....	5.18	.94	2.32	.27	1.56	.20	.73	.44	1.21	4.89	17.74	2.17	15.57	31.2	.34	.50
18†	12.10	17.78	.94	7.40	2.77	2.10	.26	1.93	.18	.63	.73	1.38	5.70	23.08	2.94	20.14	38.5	.38	.52
14‡	8.52	16.26	.....	4.40	1.00	1.65	.23	1.47	.23	.83	.29	1.27	5.40	16.77	1.37	15.40	29.3	.34	.53
9§	9.23	14.10	.....	4.71	1.24	2.41	.40	1.49	.14	.35	.43	1.36	6.26	18.79	2.47	16.32	29.7	.34	.55
3§	9.65	15.49	.14	6.09	1.35	5.13	.29	1.37	.20	.67	.67	1.11	5.25	19.13	1.83	17.30	27.4	.44	.63
17†	7.12	13.41	.....	4.88	1.99	1.98	.33	1.14	.18	.88	.58	1.15	4.85	17.96	1.79	16.17	22.8	.50	.71
19*	13.61	25.79	.....	8.11	1.07	1.51	.39	1.25	.20	1.16	1.50	1.22	4.35	20.76	1.43	19.33	24.9	.60	.78
11*	9.24	12.70	.....	4.93	2.70	1.81	.34	.85	.19	.78	.31	1.49	5.10	18.50	1.85	16.65	17.0	.68	.98
Av.	8.33** 8.42***	13.74 11.90	..... .34	4.70	1.11	2.16	.31	1.58	.19	.49	.52	1.33	5.36	17.76	1.95	15.82	31.6	.33	.50

Note: The average yields of those farms from which records were secured for the various years are as follows: 1920, 44 bushels; 1921, 17.1 bushels; 1922, 25.8 bushels; 1923, 23.8 bushels; and 1924, 50 bushels.

*Average of two years: on farms number 11 and 19 for the years 1921 and 1922; farm number 12 for 1922 and 1924; and farm number 20 for 1923 and 1924.

†Average of three-year records: on farm number 2 for the years 1920, 1922, and 1923; farm number 8 for 1920, 1923 and 1924; farm number 17 for 1921 to 1923, and farm number 18 from 1922 to 1924.

‡Average of four-year records: on farm number 7 for the years 1920, 1921, 1922, and 1924; and on farm number 14 from 1921 to 1924, inclusive.

§Average of five-year records given on the farms 3, 4, 5, and 9.

**Farms using tractors omitted from this average.

***Average of farms using tractors.

TABLE 20.—Oats: Standard Requirements for Production

Operation and implement used	Labor per acre		Acres covered in 10-hour day
	Man-hours	Horse-hours	
Discing, 7-foot, 4 horses	0.7	3.0	13.5
Drilling, 7-foot, 3 horses	.8	2.4	12.5
Broadcasting, 36-foot, 2 horses	.3	.5	40.0
Cutting, 8-foot, 4 horses	.6	2.4	16.6
Cutting, 7-foot, 3 horses	.7	2.1	13.8
Shocking, 40-bushel yield	1.1	.....	9.5
Shock threshing, 40-bushel yield	2.9	3.4	3.5

Materials per acre:
Seed, drilled, 2.6 bushels.
Seed, broadcasted, 2.9 bushels.
Twine, 2.3 pounds.

Two different methods of seeding oats were practiced. One method is by using the same drill that is used for sowing wheat, while the other method is by broadcasting with an endgate wagon seeder. By the latter method a much wider strip can be sown than with a drill, and a larger quantity of seed is used per acre. The average amount of seed sown on all farms was 2.7 bushels per acre. Those using a drill seeded an average of 2.4 bushels per acre, while those broadcasting with an end-gate seeder sowed an average of 3 bushels per acre. If grass seed is to be sown where an end-gate seeder is used, the ground must be gone over a second time, while with a drill the seed can be sown at the same time as the oats. Even when considering the above, however, less time is spent in sowing oats with an end-gate seeder than with a drill.

The amount of twine used per acre varied from 1.8 to 3.1 pounds, with an average of 2.3 pounds. Those farms having the largest yields used the most twine.

TABLE 21.—Oats: Standard Labor Requirements for Production

Operation and implement	Total labor per acre	
	Man-hours	Horse-hours
Discing, 7-foot disc, 4 horses	0.7	3.0
Drilling, 7-foot drill, 3 horses	0.8	2.4
Cutting, 8-foot binder, 4 horses	0.6	2.4
Shocking	1.1	.....
Shock threshing	2.9	3.4
Total labor (when seed drilled)	6.1	11.2
Broadcasting, 36-foot width, 2 horses	0.3	0.5
Discing, 7-foot disc, 4 horses	0.7	3.0
Cutting, 8-foot binder, 4 horses	0.6	2.4
Shocking	1.1	.....
Shock threshing	2.9	3.4
Total labor (when seed broadcasted)	5.6	9.3

TABLE 22.—Hay: Variations in Cost of Production, 1920-1924

Farm number	Labor per acre		Gross cost per acre								Pasture credit per acre	Net cost per acre	Yield per acre hay	Yield pasture and hay*	Cost per ton	
	Man	Horse	Total labor	Manure and fertilizer	Seed	Equipment	Overhead	Taxes on land	Interest on land	Total					Excluding interest	Including interest
	Hr.	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Tons*	*Index No*	*Dol.*	*Dol.*
7	11.36	10.94	5.50	1.39	1.36	0.60	0.58	1.21	4.89	15.53	5.40	10.13	1.72	158	3.05	5 88
6	5.33	4.78	2.56	2.58	1.50	.18	.11	1.15	4.80	12.88	6.24	6.64	.87	101	2.11	7.63
14	7.37	8.10	3.05	1.00	1.81	.42	.25	1.27	5.40	13.20	3.36	9.84	1.16	105	3.82	8.48
18	6.22	9.66	3.30	2.85	2.38	.34	.37	1.38	5.70	16.32	4.73	11.59	1.35	127	4.36	8.58
15	7.38	7 41	2.89	2.31	1.45	.36	.52	1.91	5.76	15.20	1.89	13.31	1.43	116	5.28	9.30
17	7.79	8.43	4.15	2.08	2.44	.55	.63	1.15	4.85	15.85	1.61	14.24	1.48	118	6.34	9.63
1	8.88	11.58	3.93	2.06	2.16	.53	.68	1.32	6.00	16.68	4.30	12.38	1.25	117	5.10	9.90
11	9.73	10.82	4.74	2.94	2.03	.67	.33	1.49	5.10	17.30	1.80	15.15	1.50	120	6.70	10.10
4	6.02	9.39	2.66	.33	1.77	.23	.47	1.61	5.40	12.47	3.39	9.08	.88	85	4.18	10.31
19	5.29	7.43	4.15	1.27	1.37	.33	.58	1.22	4.35	11.84	5.02	6.82	.64	77	4.02	10 65
5	7.28	9.86	3.73	.64	2.34	.26	.40	1.17	5.22	13.76	.11	13.65	1.21	89	6.97	11.28
3	5.33	10.94	3.79	1.16	2.04	.47	.37	1.11	5.25	14.19	4.20	9.99	.82	85	5.78	12.18
16	6 32	9.88	3.72	2.91	3.47	.43	39	1.11	5.40	17.43	4.48	12.95	1.06	104	7.19	12.21
13	9.56	6.16	3.60	3.30	1.74	.22	.94	1.47	6.30	17.57	2 82	14.75	1.20	104	7.04	12.29
10	11.64	8.82	4.63	2.28	2.77	.55	.91	.88	4.98	17.00	.07	16.93	1.35	99	8.85	12.54
9	10.97	10.83	4.69	1.51	1.84	.27	.52	1.36	6.26	16.45	.18	16.27	1.27	94	7.88	12.81
20	6.45	6.68	3.04	1.36	1 50	.39	.45	1.05	4.71	12.50	.28	12.22	.95	71	7.91	12.86
2	4.70	7.28	2.67	3.88	2.36	.32	.24	1.45	5.38	16.30	3.73	12.57	.97	93	7.43	12.95
12	10.37	5.40†	5.25	3.40	1.61	.35	.84	1.22	4.98	17.65	2.05	15.60	1.05	89	10.11	14.85
8	6.30	6.05	2.88	1.21	2.11	.27	.53	1.54	5.82	14.36	2.60	11.76	.78	73	7.63	15.07
Av.	7.33‡	8.51‡	3.62	2.07	2.04	.40	.47	1.32	5.31	15.23	2.55	12.66	1.16	100	9.08	11.46

*Index number of the value of pasture and yield of hay per acre, using the average as a base of 100.

†Also used tractor 1 57 hours per acre

‡Farm 12, which used a tractor some omitted from this average of man and horse hours

Note: Averages on farms number 2, 5, and 11 are from five year records; number 12, 14, 15, and 17 are from four year records; number 1, 3, 4, 6 7, 8, 9, 10, 13, 16, and 18 are from three year records, and averages on farms number 19 and 20 are from two year records.

By combining the standard labor requirements for the prevailing practices used in oats production, standards of total labor requirements are established for two different methods of handling the oats crop. These amounts of labor are from 26 to 33 percent less than the average amount of time spent on oats and show to what extent labor requirements can be reduced if efficiency is attained in all operations.

HAY

COST OF GROWING AND HARVESTING

Causes for farm-to-farm variations.—The cost of growing and harvesting hay varied from $5.88 to $15.07 per ton, as shown in Table 22. In this section of the State not much hay is sold, most of it being consumed on the farm where raised. The importance of rotation pasture is shown by the fact that on the average there were 10 acres of permanent pasture, 24 acres of rotation pasture, and 18 acres of hay. The division between hay and pasture was made on the basis of major use, as frequently where additional pasture for livestock was needed the fields of grass intended for hay were lightly pastured before the hay was cut. This pasturing reduced the yield of hay and should be considered in calculating the cost of hay secured from an acre.

Practically all of the hay represented in this table was timothy and clover mixed; only a very few fields were either pure timothy or clover. There was quite a variation in the amount of pasture secured and also in the amount of hay made from an acre.

STANDARD REQUIREMENTS

For harvesting hay.—The standard requirements shown in Table 23 are suggested for the harvesting of hay. With a six-foot mower, 1.8 more acres can be cut in a day than with a five-foot mower. The amount of labor required to cut the hay is less than a sixth of the total labor required to harvest hay, so the advantage of a six-foot over a five-foot mower would not be very noticeable except where a large amount of hay is harvested.

TABLE 23.—Hay: Standard Requirements for Production

Operation and implement used	Labor per acre		Acres covered in 10-hour day
	Man-hours	Horse-hours	
Mowing, 6-foot, 2 horses	0.8	1.6	12.6
Mowing, 5-foot, 2 horses	0.9	1.9	10.8
Raking, 10-foot, 2 horses	0.4	0.8	26.3
Hauling and barning, 1.5-ton yield	3.9	5.0	2.5

TABLE 24.—Hay: Standard Labor Requirements for Production

Operation and implement used	Total labor per acre	
	Man-hours	Horse-hours
Mowing, 6-foot, 2 horses	0.8	1.6
Raking, 10-foot, 2 horses	0.4	0.6
Hauling and barning, 1.5-ton yield	3.9	5.0
Total labor	5.1	7.4

PASTURE

COST OF PRODUCTION

Causes for farm-to-farm variations.—As shown in Table 1, rotation pasture was of considerable importance in the field system of this area. The cost of growing clover and timothy pasture varied from $1.41 to $3.13 per animal-unit-month of pasture secured, as shown in Table 25. The standing value of the hay cut from these pasture fields was subtracted from the gross cost to get the net cost of the pasture secured. Pasture costs were figured only for those fields where the major use was for pasture.

As all kinds of livestock were pastured, it is necessary to reduce the livestock to a common unit in order to get the cost of pasture per animal. For this purpose the animal unit has been used, based on the amount of feed consumed by one cow or horse. Other kinds of livestock have been reduced to cow equivalent on the basis of feed consumed.

The variations in cost per animal-unit-month of pasture obtained correspond very closely to the yield of grass. The variations in gross cost per acre are small. Only five farms vary more than a dollar an acre from the average gross cost. The wide variation in the net cost per animal-unit-month of pasture obtained is due to the wide range of yields.

ALFALFA

COST OF GROWING AND HARVESTING

Alfalfa was grown on four different farms and for a varying length of time. Farm 1 had the same stand of alfalfa during the five-year period. It was originally seeded two years before this study started and partially reseeded the second year. Three cuttings were made each year for hay. In 1923 one cutting was sold standing in the field.

TABLE 25.—Clover and Timothy Pasture: Variations in Cost of Production, 1920-1924

Farm number	Total labor		Gross cost per acre								Hay credit per acre	Net cost per acre	Animal-unit-months of pasture per acre	Yield pasture and hay*	Cost of pasture per animal-unit-month†
	Man	Horse	Total labor	Manure and fertilizer	Seed	Equipment	Overhead	Taxes on land	Interest on land	Total					
	Hr.	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*No.*	*Index No.*	*Dol.*
7	0.15	.....	0.04	1.39	1.36	.....	0.01	1.21	4.89	8.90	2.62	6.28	4.45	113	1.41
17	.20	0.07	.08	2.08	2.44	0.01	.02	1.15	4.85	10.63	4.85	5.78	3.88	123	1.49
14	.17	.....	.05	1.00	1.81	.....	.01	1.27	5.40	9.54	4.46	5.08	3.08	103	1.65
6	.24	.....	.07	2.58	1.50	.....	.01	1.15	4.80	10.11	1.12	8.99	5.26	115	1.71
3	.30	.73	.24	1.16	2.04	.03	.02	1.11	5.25	9.85	1.57	8.28	4.63	107	1.79
15	.17	.....	.05	2.31	1.45	.....	.01	1.91	5.76	11.49	4.33	7.16	3.98	120	1.80
18	.36	.14	.12	2.85	2.38	.01	.02	1.38	5.70	12.46	3.46	9.00	5.00	132	1.80
12	.29	.24	.12	3.40	1.61	.01	.02	1.22	4.98	11.36	2.81	8.55	4.42	114	1.93
19	.39	.25	.15	1.27	1.37	.01	.04	1.22	4.35	8.41	.72	7.69	3.86	83	1.99
4	.28	.88	.22	.33	1.77	.02	.02	1.61	5.40	9.37	.51	8.86	3.99	84	2.22
2	.40	.10	.13	3.88	2.36	.01	.02	1.45	5.38	13.23	3.74	9.49	4.11	117	2.31
13	.45	.40	.18	3.30	1.74	.01	.04	1.47	6.30	13.04	.99	12.05	5.21	113	2.31
1	.24	.....	.07	2.06	2.16	.....	.02	1.32	6.00	11.63	1.90	9.73	3.97	97	2.45
16	.49	.91	.32	2.91	3.47	.04	.03	1.11	5.40	13.28	2.69	10.59	4.23	109	2.50
5	.45	1.27	.33	.64	2.34	.03	.02	1.17	5.22	9.75	5.35	4.40	1.57	82	2.80
11	.29	.08	.10	2.94	2.03	.01	.01	1.49	5.10	11.68	3.54	8.14	2.81	89	2.90
10	.47	.36	.19	2.28	2.77	.02	.04	.88	4.98	11.16	2.30	8.86	2.96	80	2.99
8	.28	.05	.09	1.21	2.11	.01	.02	1.54	5.82	10.80	1.64	9.16	2.93	73	3.13
Av.	.30	.31	.14	1.95	2.04	.01	.02	1.37	5.28	10.90	2.58	8.32	3.82	100	2.18

*Index number of the value of pasture and hay secured per acre, using the average as a base of 100.
†Animal unit: 1 horse or 2 colts; 1 cow or two-year old heifer, 2 yearlings, 3 or 4 calves; 7 to 10 sheep or 20 lambs; 5 sows, 7 200-pound hogs.

TABLE 26.—Alfalfa Hay: Variations in Cost of Production, 1920-1924

Farm number	Length of record	Labor per acre		Cost per acre								Pasture credit per acre	Net cost per acre	Yield per acre	Cost per ton	
		Man	Horse	Total labor	Manure and fertilizer	Seed	Equipment	Overhead	Taxes on land	Interest on land	Total				Excluding interest	Including interest
	Yr.	*Hr.*	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*T.*	*Dol.*	*Dol.*
1	5	18.53	19.83*	7.89	1.73	2.18	0.91	1.43	1.32	6.00	21.46	1.52†	19.94	2.25	6.20	8.86
13	4	24.97	21.35	9.90	3.58	1.92	.75	2.45	1.47	6.30	26.37	.....	26.37	3.16	6.35	8.34
9	2	16.59	16.04	7.03	1.94	2.10	.41	.78	1.36	6.26	19.88	.....	19.88	2.62	5.20	7.59
20	1	17.20	18.34	8.20	2.18	.77	1.07	1.20	1.05	4.80	19.27	2.53	17.74	2.21	5.86	8.03

*Also used tractor .24 hour per acre.
†Credit for standing hay sold in the field.

Farm 13 had several different fields of alfalfa during the time of this study. They were cropped three years and then plowed under. Three cuttings were made each year and one year a fourth cutting was secured. Farm 13 had the highest yield of any of the farms.

Farm 9 cropped the alfalfa the first two years of record and then plowed it under in 1923. Clover and bluegrass were replacing the alfalfa. Three cuttings were made each year.

Farm 20 cropped the alfalfa only one year. Two cuttings were made and it was then pastured in the fall.

The net cost per acre in growing and harvesting alfalfa was much more than that of clover and timothy hay, but, as the alfalfa yielded over twice as much per acre, the cost per ton was materially less than that of clover hay.

SUMMARY

A group of farm cost-of-production records supplies excellent data to study and compare the methods of low-cost producers with the less efficient methods of high-cost producers.

Cost-of-production data are necessary to make a complete study of the various operations and enterprises on the farm from a business and economical point of view.

Variations in the cost-of-production of a unit of any crop were mainly due to differences in yield and labor required.

The data show that 70 percent of the total labor required to produce corn up to harvesting was for plowing and cultivating. Labor saved in using three- and five-horse teams for plowing and a two-row cultivator materially reduced the cost of producing corn.

Almost three times as much ground was plowed with a two-bottom gang plow and five horses in a ten-hour day, as with a two-horse walking plow.

In a 10-hour day 90 percent more corn was cultivated with a two-row than with a one-row cultivator.

It did not pay to cut corn merely for the stover unless hay was high in price.

Husking corn from the stalk proved the cheapest method of harvesting corn, other than hogging it off. Of the corn 28 percent was husked from the stalk and 17 percent was hogged down. A binder was used for cutting 13 percent of the corn cut in 1920, 23 percent in 1922, and 43 percent in 1924.

In husking corn from the shock and cribbing, 7.1 hours more of man-labor was required per acre than when husking and cribbing from the stalk.

In a given time 80 percent more corn was husked from the standing stalks than from the shock.

As compared with hand husking, 123 percent more corn was husked by the use of a shredder. On the average 3 bushels were husked and cribbed per man-hour when corn was husked by hand, as against 6.7 bushels per man-hour when it was husked by a shredder, after deducting time chargeable to stover.

The net cost per acre for producing wheat varied but little from farm to farm. The yield per acre caused more variation in cost per bushel than labor, as labor formed only 22 percent of the gross cost.

Labor costs comprised more than 26 percent of the gross cost of production of oats. The cost per bushel was greatly affected by the yield per acre.

When good yields of clover and timothy hay and pasture were secured, the cost of production per unit was low. Pasture costs ranged from $1.41 to $3.13 per animal unit per month.

Alfalfa hay was grown and harvested at a cost of about 30 percent less per ton than mixed clover and timothy hay.

APPENDIX

The following tables give more detailed information concerning the cost of production of various crops. The labor requirements for production are given by operations, times over, and labor required per acre once over, by farms. Amounts of seed, fertilizer, manure, and twine used are given by farms for the various crops.

TABLE 27.—Corn: Labor per Acre, by Operations for Growing, 1920-1924

Farm number	Total labor			Plowing			Dragging		Discing		
	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Man	Horse	Tractor
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*
1	8.13	11.35	3.03	2.38	3.22	1.34	0.20	0.77*	0.76	0.08	0.72
18	8.87	20.35	1.81	2.12	3.84	1.13	.32	1.28	1.52	3.35	.68
14	8.97	28.30	.....	3.22	10.17	.....	.45	1.49	1.71	7.07	.....
4	9.17	25.25	.79	2.57	8.70	.49	.33	1.40	.79	2.37	.23
3	10.11	22.52	1.43	3.12	5.64	1.14	.27	1.14	.68	1.78	.29
7	10.73	29.90	.10	3.66	11.14	.10	.89	3.13	1.13	4.31	.....
20	10.89	32.33	.....	2.49	9.22	.....	.87	2.79	1.20	4.80	.....
2	11.21	30.80	.....	4.08	12.23	.....	.50	1.41	1.34	4.36	.....
8	11.29	27.06	.37	2.98	8.45	.37	.62	1.95	1.27	5.10	.....
12	11.37	17.13	2.86	2.31	1.85	1.55	.49	.94*	.78	.....	.77
10	11.75	24.72	.82	3.96	9.10	.23	.03	.09	1.19	2.46	.59
17	11.82	35.24	....	4.00	13.31	.....	1.25	3.75	.81	3.14	.....
13	12.97	35.42	... .	3.41	12.56	.....	.29	.83	1.41	5.64	.....
6	13.53	34.10	.....	4.89	14.58	....	.84	2.69	.98	3.52	.....
5	13.86	35.82	.05	4.45	13.27	.05	.10	.38	1.01	4.04	....
11	13.90	35.21	.....	5.27	14.75	.....	.74	1.78	1.34	4.87	.....
9	14.69	33.11	.14	5.19	12.09	.14	.30	.87	1.13	3.39	.....
19	14.71	37.91	.....	5.54	15.49	... .	1.36	4.37	1.30	5.02	.....
15	14.83	33.19	.36	4.55	12.02	.24	1.06	2.77	1.54	5.47	.12
16	16.27	42.95	.....	5.12	16.12	.....	.20	.69	1.67	6.38	.....
Average‡	12.38	34.10	.....	4.11	12.91	.....	.51	1.62	1.25	4.71	.....
Average§	9.38	19.27	1.95	2.48	5.05	1.06	.....	.....	.87	1.41	.52

*Farms 1 and 12 used their tractors small amounts for dragging and harrowing.
‡Average excludes those in any particular operation where a tractor was used.
§Average of those in any particular operation where a tractor was used.

TABLE 27.—Corn: Labor Per Acre, by Operations for Growing, 1920-1924—Continued

Farm number	Harrowing		Other seedbed preparation		Planting		Replanting		Miscellaneous		Cultivation	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*
1	0.16	0.31*	0.20	0.33	0.78	1.56	0.21	0.15	0.73	0.46	2.69	4.43†
18	.07	.25	.14	.39	.84	1.68	.30	.....	.26	.58	3.31	8.98
14	.....	.....	.06	.22	.69	1.38	.02	.03	.04	.08	2.77	7.84
4	.62	1.89	.05	.12	.73	1.47	.22	.33	.11	.16	3.72	8.85
3	1.06	2.93	.20	.66	.77	1.55	.....	.....	.33	.28	3.65	8.53
7	.....	.....	.23	.49	.69	1.39	.14	.....	.27	.38	3.71	9.05
20	.06	.20	.63	1.92	.96	1.92	.34	.60	.47	.96	3.85	9.91
2	.05	.10	.26	.69	.78	1.56	.39	.13	.44	.74	3.37	9.57
8	.36	1.25	.04	.14	.66	1.33	.43	.....	.66	.39	4.25	8.44
12	.30	.86*	.58	1.07	.70	1.41	.29	.08	1.24	1.34	4.65	9.57
10	.33	.78	.05	.18	.98	2.00	.02	.....	1.05	.76	4.11	9.38
17	1.05	3.15	.....	.....	.97	1.94	.....	.....	.36	.72	3.38	9.23
13	1.17	3.43	.12	.34	.85	1.70	.40	.08	.74	.18	4.55	10.67
6	.28	.86	.17	.34	.75	1.50	.30	.....	.09	.18	5.21	10.42
5	.72	1.74	.03	1.03	.81	1.63	.....	.....	.43	.77	6.00	12.96
11	.47	.96	.39	1.15	.95	1.89	.02	.....	.17	.22	4.53	9.58
9	1.10	3.30	.46	1.15	.84	1.69	.28	.....	.40	.74	4.97	9.87
19	.39	1.64	.10	.43	.85	1.69	.90	.....	.74	.88	3.52	8.36
15	.16	.34	.09	.09	.88	1.75	.95	.08	.53	1.22	5.06	9.43
16	.70	2.63	.61	1.09	1.08	2.16	.76	1.11	.66	1.67	5.49	11.08
Average‡	.50	1.44	.20	.54	.82	1.64	.26	.10	.44	.55	4.22	9.58
Average§												

*Farms 1 and 12 used their tractors small amounts for dragging and harrowing.
†Farm 1 used a tractor for cultivation .84 hour per acre.
‡Average excludes those in any particular operation where a tractor was used.
§Average of those in any particular operation where a tractor was used.

Note: Other seedbed preparation consists of rolling, cultipacking, and dragging stalks before plowing. Miscellaneous operations are weeding, rolling, cultipacking, and hoeing after planting.

TABLE 28.—Corn: Total Labor, Times Over, and Labor Required per Acre Over Once, by Operations for Growing in 1924

Farm number	Total labor			Plowing			Dragging			Discing			
	Man	Horse	Tractor	Man	Horse	Tractor	Times over	Once over		Times over	Once over		
								Man	Horse		Man	Horse	Tractor
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*		*Hr.*	*Hr.*		*Hr.*	*Hr.*	*Hr.*
14	7.16	26.12	.....	2.45	10.37	.....	0.56	.53	2.64	1.00	1.09	5.38	.....
7	7.33	19.26	0.73	1.85	3.36	0.73	1.37	.42	1.68	1.00	.75	3.02	.....
4	7.70	18.16	1.68	2.00	4.02	1.20	.35	.47	2.14	1.00	.62	.82	.45
1	8.09	13.85	2.07	1.90	4.46	.71	0	.....	.....	1.00	.69	.30	.59
12	9.98	12.85	2.39	1.89	1.92	1.27	1.00	.51	*	1.00	.60	.....	.60
10	10.13	17.63	2.10	3.90	6.91	1.06	0	.....	.....	1.04	.98	.....	.98
3	10.25	20.00	1.63	1.88	4.74	.92	0	.....	.....	1.00	.71	.....	.71
8	10.28	27.80	.....	2.65	9.57	.....	.80	.52	1.57	1.00	.97	3.90	.....
18	10.37	17.96	3.29	2.16	.52	1.99	.70	.76	3.07	1.59	1.06	.97	.81
2	11.78	29.61	.....	3.93	11.61	.....	.60	.57	1.49	1.00	1.07	3.29	.....
20	12.06	35.83	.....	2.61	9.77	.....	1.07	.81	2.48	1.27	1.34	5.37	.....
11	12.87	33.61	.....	6.16	15.47	.....	1.00	.72	1.73	1.00	1.17	4.51	.....
13	14.22	32.76	.....	3.05	11.53	.....	.36	.80	2.12	1.00	.94	3.78	.....
6	14.93	36.56	.....	4.66	13.89	.....	1.26	.78	2.34	1.00	.84	3.35	.....
5	14.99	36.57	.....	4.65	12.28	.....	.25	.90	3.62	1.17	1.02	4.11	.....
15	15.98	36.76	.....	5.04	14.50	.....	1.48	.94	2.62	1.17	1.01	4.04	.....
9	17.14	36.44	.....	5.31	11.58	.....	.11	1.00	3.00	2.00	.74	2.22	.....
Av.†	11.90	30.48	.....	3.80	11.47	.....	.56	.71	2.27	1.13	1.15	4.42	.....
Av.‡	10.35	13.01	3.95	2.07	2.71	1.35	.....	.....	.....	1.08	.77	.44	.66

*Used tractor .51 hours per acre over once.

†Average excludes those using a tractor in any particular operation.

‡Average of those using tractors in any particular operation.

Note: Total labor is the actual amount used in the production of corn. "Times over" denotes the number of times any one operation was used or what portion of the field was covered. The hours of labor to do each operation once over per acre show the rate at which the operation was accomplished, as farm 14 dragged his corn ground .56 time, at the rate of .53 man-hour per acre. The actual labor used would be .56 multiplied by .53 which gives .29 hour per acre.

TABLE 28.—Corn: Total Labor, Times Over, and Labor Required per Acre Over Once, by Operations for Growing in 1924—Con'd

Farm number	Harrowing			Miscellaneous‡			Planting		Replanting		Hoeing	Cultivation		
	Times over	Once over		Times over	Once over		Man	Horse	Man	Horse	Man	Times over	Once over	
		Man	Horse		Man	Horse							Man	Horse
		Hr.	*Hr.*		*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*		*Hr.*	*Hr.*
14	0	.....	.....	.....	.....	.....	0.67	1.37	0.10	0.20	.....	3.23	0.79	2.26
7	0	.....	.....	0.37	0.30	1.51	.58	1.16	.15	.....	.....	3.00	1.10	3.03
4	1.06	.69	2.35	.08	.44	1.78	.64	1.28	.12	.21	.....	3.25	1.04	2.59
1	.41	.68	2.05	.64	.63	.79*	.68	1.36	.46	.....	.40	3.24	1.00	1.96†
12	0	.....	.....	.89	.80	1.75	.72	1.45	.57	.....	.99	3.00	1.32	2.64
10	0	.....	.....	0	.....	.....	1.05	2.10	.....	.....	1.12	3.15	.96	2.74
2	2.20	.61	1.83	.19	1.29	1.29	.72	1.45	.....	.....	.94	3.43	1.29	2.78
8	.83	.65	1.94	.40	.59	1.77	.61	1.22	.08	.....	.....	3.40	1.40	2.80
18	0	.....	.....	.12	.67	1.33	1.04	2.09	.38	.....	.....	3.70	1.21	3.09
2	.25	.50	1.00	1.12	.66	1.47	.81	1.62	.58	.06	.34	4.20	.90	2.26
20	.09	.60	2.40	.65	1.05	2.84	1.04	2.09	.04	.....	.....	3.06	1.65	4.06
11	.94	.64	1.28	.17	1.00	3.00	.92	1.83	.05	.....	.....	2.50	1.23	3.33
13	1.91	.72	2.29	.27	.73	2.93	.77	1.54	.68	.....	2.46	3.72	1.19	2.68
6	0	.....	.....	1.00	.84	1.68	.84	1.68	.25	.....	.....	4.39	1.48	2.96
5	.66	.75	1.89	.46	.95	2.40	1.09	2.19	.....	.....	.18	3.00	2.22	4.66
15	.11	.75	2.26	.58	.71	1.93	.72	1.41	1.18	.....	.....	3.46	1.72	3.13
9	1.27	.74	2.00	1.70	.63	1.75	.77	1.55	1.03	.....	.....	3.54	1.81	3.69
Av.	.58	.68	2.03	.47	.73	1.82	.79	1.55	.34	.04	.39	3.16	1.30	2.96

*Also used tractor .24 hour per acre.
†Also used tractor .19 hour per acre for cultivation.
‡Miscellaneous operations are rolling, cultipacking and weeding.

TABLE 29.—Corn: Units of Materials Used for Production, 1920-1924

Farm number	Average per acre				
	Manure*	Fertilizer†	Seed	Twine	Yield
	Loads	*Lb.*	*Lb.*	*Lb.*	*Bu.*
16	1.7	56.7	12.1	0.44	55.7
2	2.1	27.4	10.9	0.65	53.7
13	2.5	37.4	11.5	0.75	51.7
17	1.4	.....	10.7	1.14	50.4
11	2.4	88.3	10.7	0.46	50.2
9	1.0	.....	10.4	0.18	49.6
15	2.6	17.0	7.9	0.32	48.1
14	0.6	.....	9.7	0.26	47.1
12	1.1	98.9	10.6	0.48	46.0
19	0.6	.....	9.5	.....	45.4
5	0.5	.....	9.1	.....	44.6
7	0.9	4.3	10.9	.....	44.5
4	0.4	.....	11.6	0.04	42.5
8	1.3	18.2	10.4	0.41	41.9
18	2.8	52.4	9.3	1.29	40.3
1	2.0	8.4	12.7	0.78	39.8
10	1.0	80.6	10.5	1.97	39.6
6	1.7	29.8	10.0	1.79	38.4
3	0.9	30.5	10.7	0.96	37.7
20	0.8	71.8	11.1	0.97	36.4
Average	1.4	28.9	10.7	0.55	45.0

*Amount of manure applied during the rotation charged to corn.
†Pounds of fertilizer applied at time of planting.

TABLE 30.—Wheat: Labor per Acre, by Operations, for Growing and Harvesting, 1921-1924

Farm number	Total labor			Plowing			Discing			Miscellaneous*	
	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*
8	6.62	9.66	....	.....	.....	.....	.10	.40	....	... .	.....
14	6.95	10.10	.....	....	.....	....	.07	.14	.....	.03	.07
6	7.32	8.94	.. ..	.. ..	.....	....	.07	.22	.....	.....	....
17	7.66	10.83	.....	.....	....	.....	.....	.....	.....	.....	.....
1	7.78	11.99	.27	.....	.....	.....	.42	.43	.27	.02	.04
2	7.80	10.30	.....	... .	... .	.....	.36	.86	.....	.17	.36
16	7.85	13.65	... .	.....	.....	.....	1.05	4.22	.....	.24	.71
13	8.64	12.71	.....	.25	.99	....	.08	.32	....	.49	1.22
15	8.88	16.66	.....	1.43	4.14	... .	.46	2.22	.....	.22	.06
12	9.01	7.47	1.02	.....	.....	.....	.05	.....	.05	.....	.....
20	9.25	12.05	.. ..	.....	.....	.....	.39	1.56	.....	.....	.....
7	9.40	14.94	.....	.83	2.51	.....	.83	2.62	.....	.07	.30
10	10.08	14.33	.35	.44	.25	.35	.42	.75	.....	.42	.39
18	10.31	14.80	.31	.81	2.14	.13	.64	1.79	.18	.20	.70
11	10.94	13.88	.....	.59	1.59	.....	.11	.38	....	.24	.36
Av.§	8.31	12.06	....	.22	.66	.....	.43	1.49	.....	.15	.32

TABLE 30.—Wheat: Labor per Acre, by Operations, for Growing and Harvesting, 1921-1924—Continued

Farm number	Drilling		Cutting		Shocking	Shock threshing		Barn threshing**		Yield per acre
	Man	Horse	Man	Horse	Man	Man	Horse	Man	Horse	
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Bu.*
8	1.05	2.98	.58	2.35	1.26	3.61	3.93	.....	.....	18.6
14	.81	2.47	.65	2.58	1.28	4.09	4.83	.....	.....	18.3
6	1.24	2.48	.76	2.76	2.01	3.27	3.47	.....	.....	16.0
17	1.03	3.08	1.36	3.22	1.41	3.84	4.53	.....	.....	16.9
1	1.13	3.38	.63	2.51	1.46	4.12	5.62	.....	.....	20.0
2	.89	2.68	.73	2.11	1.41	2.97	3.45	1.26	.84	21.9
16	1.08	3.25	.75	2.50	1.62	3.10	2.97	.....	.....	16.2
13	1.09	3.23	.71	2.13	1.70	4.30	4.81	.....	.....	23.4
15	.96	2.88	.72	2.90	1.47	3.61	4.47	.....	.....	20.8
12	1.07	2.56†	1.18	‡	2.25	4.45	4.91	.....	.....	21.4
20	1.22	2.44	1.11	3.32	2.36	4.15	4.72	.....	.....	13.8
7	.94	2.83	.64	2.57	1.13	1.29	1.72	3.65	2.40	20.0
10	1.34	3.91	1.03	3.90	2.14	4.30	5.12	.....	.....	17.3
18	1.01	3.12	.79	2.36	1.15	.....	.....	5.71	4.67	22.7
11	1.30	3.58	1.00	3.01	1.97	1.41	1.82	4.30	3.12	23.2
Av.§	1.10	3.12	.82	2.72	1.95	3.91	4.54	.94	.69	19.6

*Miscellaneous operations are harrowing, rolling, and cultipacking.
†Also used tractor .18 hours per acre for drilling.
‡Used tractor .79 hours for cutting wheat.
§Average excludes those in any particular operation where a tractor was used.
**Barn threshing also includes hauling wheat in from the field and putting in mow, as well as the threshing.

TABLE 31.—Wheat: Total Labor, Times Over, and Labor Required per Acre Once Over, by Operations, for Growing and Harvesting, 1923

Farm number	Total labor		Discing			Other seedbed preparation			Drilling		Cutting		Shocking	Threshing		Yield per acre
	Man	Horse	Times over	Once over		Times over	Once over		Man	Horse	Man	Horse	Man	Man	Horse	
				Man	Horse		Man	Horse								
	Hr.	*Hr.*		*Hr.*	*Hr.*		*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Bu.*
1	6.50	9.27*	1.00	0.54	*	.....	.....	.....	1.08	3.17	0.59	2.36	1.60	2.68	3.73	21.7
8	6.50	9.19	.09	1.20	4.40	.....	.....	.....	.96	2.91	.55	2.20	1.29	3.55	3.55	20.7
17	6.79	10.26	.....	.....	.....	.....	.....	.....	1.10	3.38	1.02	3.08	1.75	2.91	3.88	19.8
6	6.87	8.38	.....	.....	.....	.....	.....	.....	1.37	2.74	.87	3.48	2.13	2.69	2.15	18 4
19	6.93	9.73	1.00	.63	2.09	.....	.....	.....	1.28	2.57	.93	2.27	.81	3.26	2.79	21.0
13	7.86	10.81	.11	.75	3.00	.11	.58	1.16	1.16	3.34	.70	2.10	1.94	3.92	4.90	26.0
2	8.00	10.77	.....	.....	.....	.....	.....	.....	.95	1.96	.74	2.22	1.58	4.73	5.68	28.7
10	8.73	13.25	1.00	1.23	2.46	.....	.....	.....	.97	1.94	1.13	4.54	2.26	3.11	4.28	19.9
20	9.06	10.72	.....	.....	.....	.....	.....	.....	1.38	3.77	1.31	3.87	2.38	3.97	4.05	11.7
12	9.44	8.76†	.....	.....	.....	.....	.....	.....	.96	2.65	1.18	†	2.20	5.30	6.11	25.7
9	9.44	14.12	1.00	1.34	4.03	.....	.....	.....	1.62	3.24	.92	2.77	2.52	3.00	4.04	10.7
15	9.70	19.99	.41	1.60	5.40	1.26	5.31‡	15.32	.90	2.78	.62	2.49	1.33	3.34	3.94	18.2
16	9.84	15.39	1.00	1.14	4.57	1.00	.81	2.43	1.00	3.00	.69	2.08	2.44	3.77	3.34	22.3
7	10.45	12.14	1.00	.77	2.32	.....	.....	.....	1.16	3.49	.56	2.25	1.09	6.80§	4.07	25.0
18	10.96	18.01	1.00	.91	3.56	.66	3.51‡	12.09	.98	3.10	.84	2.52	.98	6.05§	4.76	22.0
11	12.15	20.93	.36	.75	3.00	.72	7.28‡	17.48	1.27	3.37	1.08	3.23	1.91	4.93	5.62	29.1
Av.**	8.79	13.12	.72	1.03	3.38	.75	3.49	9.69	1.13	2.96	.83	2.69	1.76	3.70	4.18	21.3

*Used tractor for discing .54 hour per acre, on farm number 1.
†Used tractor for cutting 1.16 hours per acre, on farm number 12.
‡Includes plowing of part of ground seeded.
§Barning and barn threshing on farms number 7 and 18.
**Average of those using only horses in any particular operation.

TABLE 32.—Wheat: Units of Materials Used for Production, 1921-1924

Farm number	Average per acre					
	Manure*	Fertilizer†	Seed	Twine	Threshing coal	Yield
	Loads	*Lb.*	*Bu.*	*Lb.*	*Lb.*	*Bu.*
13	1.6	222	1.8	2.4	.....	23.4
11	1.6	145	1.8	2.7	.....	23.2
18	1.7	196	1.9	2.3	.....	22.7
2	1.7	194	1.7	2.8	.....	21.9
12	.9	185	1.9	2.6	32	21.4
15	2.0	157	2.0	2.1	.....	20.8
1	1.6	160	2.0	2.2	46	20.0
7	.8	180	2.0	2.1	45	20.0
8	.8	195	1.8	2.4	.....	18.6
14	.5	154	2.0	2.1	57	18.3
10	.7	224	2.0	2.1	59	17.3
17	.9	199	1.8	2.4	39	16.9
16	1.6	222	1.9	2.5	73	16.2
6	1.4	162	2.0	2.6	75	16.0
20	.9	194	2.0	1.7	.....	13.8
Average	1.2	182	1.9	2.3	53	19.8

*Amount of manure applied during the rotation charged to wheat.
†Pounds of fertilizer applied at time of seeding.

TABLE 33.—Oats: Labor per Acre for Growing and Harvesting, 1920-1924

Farm number	Total labor			Plowing			Discing			Miscellaneous*		Drilling		Cutting		Shocking	Threshing		Yield per acre
	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Man	Horse	Man	Horse	Man	Man	Horse	
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Bu.*
5	6.68	11.56	.....	.....	.....	.....	0.95	3.80	.....	0.09	0.29	0.31†	0.62	0.72	2.89	1.34	3.25	3.96	32.9
17	7.12	13.41	.....	.....	.....	.....	1.12	4.54	.....	.....	.....	1.05	3.13	.86	2.33	1.21	2.84	3.39	22.9
4	7.30	10.16	0 23	.....	.....	.....	.53	1.31	0.23	.09	.29	.32†	.65	.90	2.83	1.24	4.21	5.09	29.7
8	7.90	15.37	.....	.....	.....	.....	1.37	5.27	.....	.38	.99	.93	2.85	.65	2.63	1.15	3.40	3.62	36.7
2	8.03	12.63	.....	.....	.....	.....	1.73	5.18	.....	.....	.....	.51	1.16	.69	2.10	1.09	3.99	4.19	35.9
14	8.52	16.26	.....	.....	.....	.....	1.31	5.05	.....	.16	.65	.85	2.59	.84	2.91	1.50	3.84	5.05	29.3
7	8.65	13.30	.....	.40	1.21	.....	.84	2.47	.....	.01	.48	.86	2.45	.78	2.86	1.21	4.36	3.79	31.2
9	9.23	14.10	.....	.....	.....	.....	1.35	3.94	.....	.....	.....	1.00	1.81	1.07	3.60	2.13	3.68	4.73	29.7
11	9.24	12.70	.....	.....	.....	.....	1.03	3.35	.....	.....	.....	.93	2.83	.98	2.94	1.60	4.64‡	3.32	17.0
3	9.65	15.49	.14	.30	.90	.08	.91	3.38	.08	.18	.62	.60†	1.27	.89	2.42	1.24	5.52	6.90	27.4
12	10.23	8.08	1.67	.....	.....	.....	.80	.....	.80	1.16	2.33	.44†	1.33	1.75	§	1.38	5.24	4.22	39.1
18	12.10	17.78	.94	1.88	4.78	.02	1.06	1.72	.06	.04	1.55	1.14	3.43	.81	2.45	1.51	5.19‡	3.84	38.5
20	13.61	17.64	.....	.....	.....	.....	1.54	5.26	.....	.02	.04	1.37	2.66	1.00	3.02	3.46	6.01	2.63	68.6
19	13.61	25.79	.....	2.93	8.79	.....	1.64	6.58	.....	.41	1.64	.87	1.75	.82	2.82	1.70	5.22‡	5.03	24.9
Av.**	8.33	13.74	.....	.09	.26	.....	1.19	4.16	.....	.14	.40	.62	1.43	.86	2.85	1.46	4.46	5.15	31.3
Av.††	8.42	11.90	.34	.59	1.61	.12	.68	1.79	.12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Miscellaneous operations are harrowing, rolling, and cultipacking.
†Farms 4 and 5 used an endgate seeder for sowing, also farms 3 and 12 for a small amount.
‡Farms 11 and 18 threshed from barn, and farm 19 threshed half from the barn.
§Used tractor .87 hour per acre for cutting.
**Average excludes those using tractors in any particular operation.
††Average of those using tractors in any particular operation.
Note: This table includes 5-year records on farms 3, 4, 5, and 9; 4-year records on farms 7 and 14; 3-year records on farms 2, 8, 17, and 18; and 2-year records on farms 11, 12, 19, and 20.

TABLE 34.—Oats: Total Labor, Times Over, and Labor Required per Acre Once Over, by Operations, for Growing and Harvesting, 1924

Farm number	Total labor			Plowing		Discing			Miscellaneous			Drilling		Cutting		Shocking	Threshing		Yield per acre
	Man	Horse	Tractor	Man	Horse	Times over	Once over		Times over	Once over		Man	Horse	Man	Horse	Man	Man	Horse	
							Man	Horse		Man	Horse								
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*		*Hr.*	*Hr.*		*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Bu.*
5	6.07	11.03	.....	.....	.....	1.00	0.96	3.71	.....	.....	.....	0.19*	0.38	0.64	2.58	1.45	2.81	4.35	51.7
15	6.56	8.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.89	2.68	.59	2.38	1.11	3.97	3.52	45.0
4	8.38	8.53	0.36	.....	.....	.98	.36	†	.....	.....	.....	.20*	.41	.69	2.60	1.85	5.27	5.51	44.0
8	8.47	15.31	.....	.....	.....	2.00	.84	3.38	.56	.90	1.80	.73	2.20	.56	2.25	1.46	3.50	3.16	44.1
14	9.05	13.50	.....	.....	.....	.75	.73	2.40	.....	.....	.....	.70	2.10	.70	2.80	1.70	5.40	6.80	50.3
10	10.09	12.26	1.08	.....	.....	1.00	1.08	†	.....	.....	.....	1.13	2.66	1.31	4.34	2.17	4.43	5.24	47.3
9	10.38	14.26	.....	.....	.....	1.37	.77	2.32	.....	.....	.....	1.05	2.11	1.29	3.88	2.62	4.35	5.09	41.4
12	10.78	10.89	1.59	.....	.....	1.00	.60	†	2.00	.88	1.76	.66	1.99	1.99	†	1.43	4.25	4.97	47.0
3	12.23	20.12	.45	1.67	4.97‡	.40	.75	2.25	1.00	.60	1.80	1.16	3.50	.42	1.69	1.38	5.78	5.99	45.6
20	14.59	18.86	.....	.....	.....	1.59	1.01	3.69	.31	.81	1.62	1.32	2.63	1.05	3.16	3.65	6.68	6.59	75.0
7	17.16	24.00	.....	3.41	10.25	.....	.....	.....	2.00	.51	2.04	.69	2 08	.82	3.28	1.77	8.36§	3.80	48.7
18	17.57	26.16	1.38	4.53	11.53‡	1.00	.69	†	2.00	.59	1.87	.98	2.94	.98	2.95	2.16	5.62§	3.94	59.9
Av.**	10.34	15.08	.....	.....	.....	.92	.84	2.96	.65	.72	1.82	.93	2.49	.82	2.90	1.89	5.04	4.91	50.0

*Farms 4 and 5 used endgate seeder for sowing.

†Tractor used for discing .36 hour on farm 4; 1.08 hours on farm 10; .60 hour on farm 12; and .69 hour on farm 18. Used tractor .99 hour for cutting on farm 12.

‡Tractor used about half an hour for plowing on each of the farms 3 and 18.

§Barning and barn threshing on farms 7 and 18.

**Average of those using only horses in any particular operation.

TABLE 35.—Oats: Units of Materials Used for Production, 1920-1924

Farm number	Average per acre				
	Manure*	Seed	Twine	Threshing coal	Yield
	Loads	*Bu.*	*Lb.*	*Lb.*	*Bu.*
20	0.9	2.5	3.1	40	68.6
12	.9	2.8	2.4	.....	39.1
18	1.7	2.9	2.2	48	38.5
8	.8	2.3	2.2	41	36.7
2	1.7	2.5	2.7	.....	35.9
5	.4	2.7	2.2	48	32.9
7	.8	2.7	2.2	60	31.2
4	.3	3.2	2.2	50	29.7
9	1.2	3.0	3.1	39	29.7
14	.5	2.3	1.8	65	29.3
3	1.0	2.8	2.1	59	27.4
19	.4	2.1	2.1	50	24.9
17	.9	2.8	2.3	44	22.8
11	1.6	2.5	2.4	54	17.0
Average	.9	2.7	2.3	45	31.6

*Amount of manure, applied during the rotation, charged to oats.

TABLE 36.—Hay: Labor per Acre, by Operations, for Production, 1920-1924

Farm number	Total labor		Seeding		Mowing		Raking		Tedding		Loading and hauling		Yield per acre
	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*T.*
2	4.70	7.28	0.40	0.10	1.02	2.06	0.33	0.65	0.17	0.35	2.78	4.13	0.97
19	5.29	7.43	.39	.25	1.00	2.00	.81	1.09	.....	.....	3.09	4.09	.64
3	5.33	10.94	.30	.73	1.00	2.00	1.68	4.14	.....	.....	2.36	4.07	.82
6	5.33	4.78	.24	.....	.77	1.59	.46	.51	.....	.....	3.86	2.67	.87
4	6.02	9.39	.28	.88	.91	1.83	.34	.68	.....	.....	4.48	6.00	.88
18	6.22	9.66	.36	.14	.81	1.63	.05	.09	.17	.35	4.83	7.44	1.35
8	6.30	6.05	.28	.05	.81	1.64	.34	.39	.....	.....	4.86	3.97	.78
16	6.32	9.88	.49	.91	.93	1.87	.53	.76	.....	.....	4.32	6.34	1.06
20	6.45	6.68	.25	.....	1.03	2.06	.56	1.03	.26	.52	4.35	3.05	.95
5	7.28	9.86	.45	1.27	1.21	2.42	.65	1.31	.....	.....	4.97	4.85	1.21
14	7.37	8.10	.17	.....	.95	1.91	.28	.51	.....	.....	5.95	5.66	1.16
15	7.38	7.41	.17	.....	.90	1.82	.23	.31	.14	.28	5.92	4.99	1.43
17	7.79	8.43	.20	.07	.88	1.76	.....	.....	.04	.04	6.66	6.57	1.48
1	8.88	11.58	.24	.....	1.22	2.44	.97	1.21	.....	.....	6.45	7.92	1.25
13	9.56	6.16	.45	.40	.85	1.73	.40	.40	.....	.....	7.86	3.63	1.20
11	9.73	10.82	.29	.08	1.02	2.39	.51	.94	.69	1.22	7.18	6.19	1.50
12	10.37	5.40	.29	.24	.66	1.29	.....	.....	.19	.38	9.23	3.49*	1.05
9	10.97	10.83	.23	.37	1.38	2.76	.52	.53	.05	.15	8.78	7.02	1.27
7	11.36	10.94	.15	.....	1.12	2.23	.33	.67	.24	.40	9.52	7.59	1.72
10	11.64	8.82	.47	.36	1.09	2.20	.63	.63	.25	.49	9.20	5.14	1.35
Av.†	7.33	8.51	.31	.29	.97	1.95	.39	.67	.13	.25	5.45	5.23	1.16

*Also used tractor 1.57 hours per acre in loading and hauling hay.
†Average of farms not using tractors.

TABLE 37.—Hay: Total Labor and Labor Required per Acre Over, by Operations, for Harvesting, 1924

Farm number	Total labor		Mowing		Raking*		Loading and hauling		Yield per acre
	Man	Horse	Man	Horse	Man	Horse	Man	Horse	
	Hr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*T.*
2	3.03	5.27	0.97	1.95	0.42	0.84	1.64	2.43	0.90
18	3.80	7.60	1.20	2.40	.60	1.20	2.00	4.00	.50
15	4.59	8.53	1.31	2.63	.66	.66	2.63	5.25	1.09
6	4.84	4.06	1.09	2.19	.32	.64	3.44	1.25	.63
5	5.40	6.36	1.02	2.30	.30	.60	4.08	3.72	.78
1	5.78	7.00	1.67	3.33	.67	.67	3.44	3.00	1.00
14	6.34	7.14	.79	1.58	.43	.43	5.12	5.12	1.01
20	6.42	6.23	1.04	2.12	.49	.83	4.87	3.29	1.00
3	6.80	1.15	1.00	2.00	.75	1.50	5.00	8.00	.75
13	7.49	6.24	.68	1.36	.34	.34	6.47	4.54	1.02
12	9.23	3.53†	.71	1.41	.....	.....	8.53	2.12†	1.12
10	10.07	9.13	1.19	2.39	1.04	1.04	7.84	5.71	1.30
11	11.28	1.69	1.14	5.14	.86	1.71	9.28	10.00	1.71
9	12.88	12.00	1.63	3.25	.63	.63	10.62	8.13	1.50
Av.‡	6.82	6.34	1.10	2.20	.57	.79	5.11	4.95	1.02

*All farms raked once over except number 12.
†Also a tractor was used 1.41 hours per acre in loading and hauling hay.
‡Average of those using only horses in any particular operation.

TABLE 38.—Hay and Pasture: Units of Materials Used for Production, 1920-1924

Farm number	Average per acre		
	Manure*	Timothy seed	Clover seed
	Loads	*Lb.*	*Lb.*
1	0.7	1.58	6.40
2	2.0	1.88	7.72
3	.8	1.78	7.37
4	.2	1.66	5.62
5	.4	1.59	6.90
6	1.3	3.27	4.51
7	.6	3.17	4.09
8	.5	1.02	6.42
9	.7	4.61	5.84
10	.6	.87	9.12
11	1.2	1.72	6.29
12	1.4	3.99	9.9
13	1.5	3.37	6.21
14	.5	3.36	7.12
15	1.5	2.22	5.60
16	.9	5.57	8.57
17	.8	4.05	6.04
18	1.3	3.53	9.03
19	.3	.40	5.1
20	.4	3.66	6.00
Average	.8	2.52	6.71

*Amount of manure, applied during the rotation, charged to hay and pasture.

TABLE 39.—Alfalfa Hay: Labor per Acre, by Operations, for Production, 1920-1924

Farm number	Length of record	Total labor		Seeding*		Mowing		Raking		Shocking	Hauling and loading		Total yield per acre	Cuttings per year
		Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Man	Horse		
	Yr.	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*Hr.*	*T.*	*No.*
1	5	18.53	19.83	0.69	0.47†	3.19	6.38	1.98	2.90	3.74	8.92	10.08	2.25	2.8
13	4	24.97	21.35	3.13	5.44	2.91	5.82	2.04	2.04	4.09	12.80	8.05	3.16	3.3
9	2	16.59	16.04	.35	.70	3.07	6.14	1.26	1.26	4.15	7.77	7.94	2.62	3.0
20	1	17.20	18.34	.20	.40	3.23	6.46	1.27	1.27	3.06	9.44	10.20	2.21	2 0

*Seeding labor distributed by years over life of stand.
†Also used tractor .24 hour per acre.